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ES DEPARTMENT OF THE INTERIOR

FINAL ENVIRONMENTAL IMPACT STATEMENT

VOLUME 1 OF 3



PROPOSED 1978 OUTER CONTINENTAL SHELF OIL AND GAS LEASE SALE SOUTH ATLANTIC OCS SALE NO. 43

PREPARED BY THE BUREAU OF LAND MANAGEMENT

THE METRIC SYSTEM OF MEASUREMENT

On December 23, 1975, President Gerald R. Ford signed the Metric Conversion Act of 1975 (Public Law 94-168), which established that the policy of the U.S. Government shall be to coordinate and plan the increasing use of the metric system in the United States. The law also established a U.S. Metric Board to coordinate the voluntary conversion to the metric system. The Metric Board will develop and carry out a broad program of planning, coordination, and public education to implement the policy established by this Act. The Act did not provide the Metric Board with any compulsory powers. The United States is the only major industrial power that has not fully converted to the metric system.

What is the Metric System? The metric system is a standard for weights and measures that is based on the decimal system. All units are multiples of or can be divided by ten and the standards for length, mass, and volume are related. For example, one gram (mass) is measured as the weight of one cubic centimeter of water at its temperature of maximum density and the liter (volume) is a cubic decimeter.

The metric system is simple to learn. There are only ten units one must know for everyday use. Most units can easily be equated with the English system of measure we now use; but there are others, such as temperature, that we will need to get used to. Some metric units, such as time and electricity, are the same as what is in use now.

The basic units of the metric system are: the meter - a little larger than a yard (about 1.1 yards), the liter - a little larger than a quart (about 1.06 quarts), and the gram - a little more than the weight of a paper clip. There are three common prefixes used with these units: mili, meaning one-thousandth (0.001); centi, meaning one hundredth (0.01); and kilo meaning one thousand times (1,000). For example, 1,000 millimeters equals one meter, 100 centimeters equals one meter, and 1,000 meters equals 1 kilometer.

Learning the metric system is much easier than learning the English system. However, in changing from one system to another one tends to think in terms of the old system. Listed below are the units used in the metric system, equivalent units in the English system, and factors for converting from the metric to the English system:

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

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FINAL

ENVIRONMENTAL IMPACT STATEMENT

PROPOSED
1978
OCS OIL AND GAS LEASE SALE

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SUMMARY: PROPOSED OCS LEASE SALE NO. 43

( ) Draft (X) Final Environmental Statement

Department of the Interior, Bureau of Land Management, New Orleans OCS Office, New Orleans, Louisiana

1. Proposed Oil and Gas Lease Sale, South Atlantic Outer Continental Shelf.

(X) Administrative ( ) Legislative Action

2. This proposed oil and gas lease sale is an initial sale of the South Atlantic OCS Frontier Region (see Figure A-1).

Two hundred twenty five tracts (518,400 hectares—1,280,966 acres) of OCS lands are proposed for leasing action. The tracts are located offshore of South Carolina, Georgia, and Florida with distance to shore ranging from approximately 48 to 120 kilometers (30 to 75 mi.). The tracts are situated in water depths that range from approximately 13 to 165 meters (43 to 540 ft). If implemented, this sale is tentatively scheduled to be held in 1978.

Development at the following level is expected: 10 to 25 platforms, 255 to 720 wells, 80 to 320 miles of pipeline, 1 to 2 terminals, storage areas, and processing plants.

3. An oil risk analysis was made for 19 resource categories. Each proposed lease tract has received a proximity evaluation using a matrix technique to identify significant environmental impacts should leasing and subsequent oil and gas exploration and production ensue.

All tracts offered pose some degree of risk to the environment. Accidental or chronic oil spillage is the chief potential cause of impact. Other sources of impact include platform and pipeline installation.

The principal adverse impacts that will occur include: some effects on recreational beaches from Daytona Beach, Fla. to Cape Fear, N.C., localized effect on recreational and commercial fishing grounds particularly scallops, crabs and oysters, benthos organisms at the localized sites of development, some potential danger to marine mammal habitat, minimal effect on diving birds and waterfowl, and unknown but potential effects on archaeological sites.

Existing air and water quality onshore will be adversely impacted by operations of gas processing plants, and any additional refineries, should they be constructed.

Beneficial economic impact is anticipated in employment and income with some adverse effect from induced development growth patterns in local areas.

4. Alternatives to the Proposed Action:

A. Hold the Proposed Sale in Modified Form
B. Delay the Proposed Sale
C. Withdraw the Proposed Sale
D. Other Alternatives Within the Proposed Action
E. Alternative Scenarios of Development

5. Comments have been received from the following (see Section IX.):

Department of Commerce
Department of Defense
Department of Health, Education, and Welfare
Department of Interior
Department of State
Department of Transportation
Environmental Protection Agency
Federal Energy Agency
Federal Power Commission
Nuclear Regulatory Commission
State of North Carolina
State of South Carolina
State of Georgia
State of Florida

6. Draft statement made available to Council on Environmental Quality and the public on February 16, 1977.

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Section 1

Description of the Proposal

A. Proposed Lease Sale

1. Location and Resources

The proposed Federal action under consideration hs the leasing of 225 tracts (each tract consists of 2304 hectares; 5,693.18 acres; or approximately 9 square miles in area) on the South Atlantic Outer Continental Shelf (OCS), in an area known as the Southeast Georgia Embayment (Figure A-1 and Visual No. 1S). These tracts comprise an area of 518,400 hectares (1,280,966 acres). They are located from approximately 48 to 120 kilometers (30 to 75 miles) offshore South Carolina, Georgia, and Florida; and in water depths of approximately 13 to 165 meters (43 to 540 feet). The tracts are summarized by water depth and distance from shore in Appendix A. They are being proposed to be leased for exploration, development and production of potential oil and gas resources in accordance with Section 8 of the Outer Continental Shelf (OCS) Lands Act (76 Stat. 462; 43 U.S.C.; Sec. 1337) and regulations issued under that Act.

The proposed action constitutes a first proposed sale in a frontier area, and does not represent proposed development of all of the potential resources of the Southeast Georgia Embayment region.

Undiscovered resources are defined as those quantities which are reasonably expected to exist in favorable geologic settings, but which have not yet been identified by drilling. If exploration confirms the existence of recoverable hydrocarbons, such resources would be reclassified as "reserves".

The U.S. Geological Survey (USGS) estimated in July 1976 (Appendix B) that, based on proprietary geophysical data, the 225 tracts proposed to be leased may contain undiscovered recoverable resources ranging from 0.28 to 1.0 billion barrels of oil and 1.9 to 6.8 trillion cubic feet of gas. Based on these estimates, the proposed action may result in peak daily production of between 56 to 170 thousand barrels of oil and 0.47 to 1.4 billion cubic feet of gas, peaking approximately 14 years after production has commenced. The estimated production life of this proposed oil and gas project is 25 years.

B. Tract Selection Process

1. Procedure and Nominations

As a first step in the tract selection process, the Department identified a large potential leasing area within the Southeast Georgia Embayment to be opened to nominations. The broadest east-west extent of this area is approximately 239 kilometers (approximately 148 miles) and the longest north-south extent of this area is approximately 608 kilometers (approximately 378 miles). The area contains approximately 8.4 million hectares (approximately 20.7 million acres) and lies between 28 degrees and 34 degrees north latitude off the coasts of Florida, Georgia, South Carolina and North Carolina. Blocks within the area lie approximately 4.8 to 212 kilometers (approximately 3 to 132 miles) from shore (See Figure A-1).

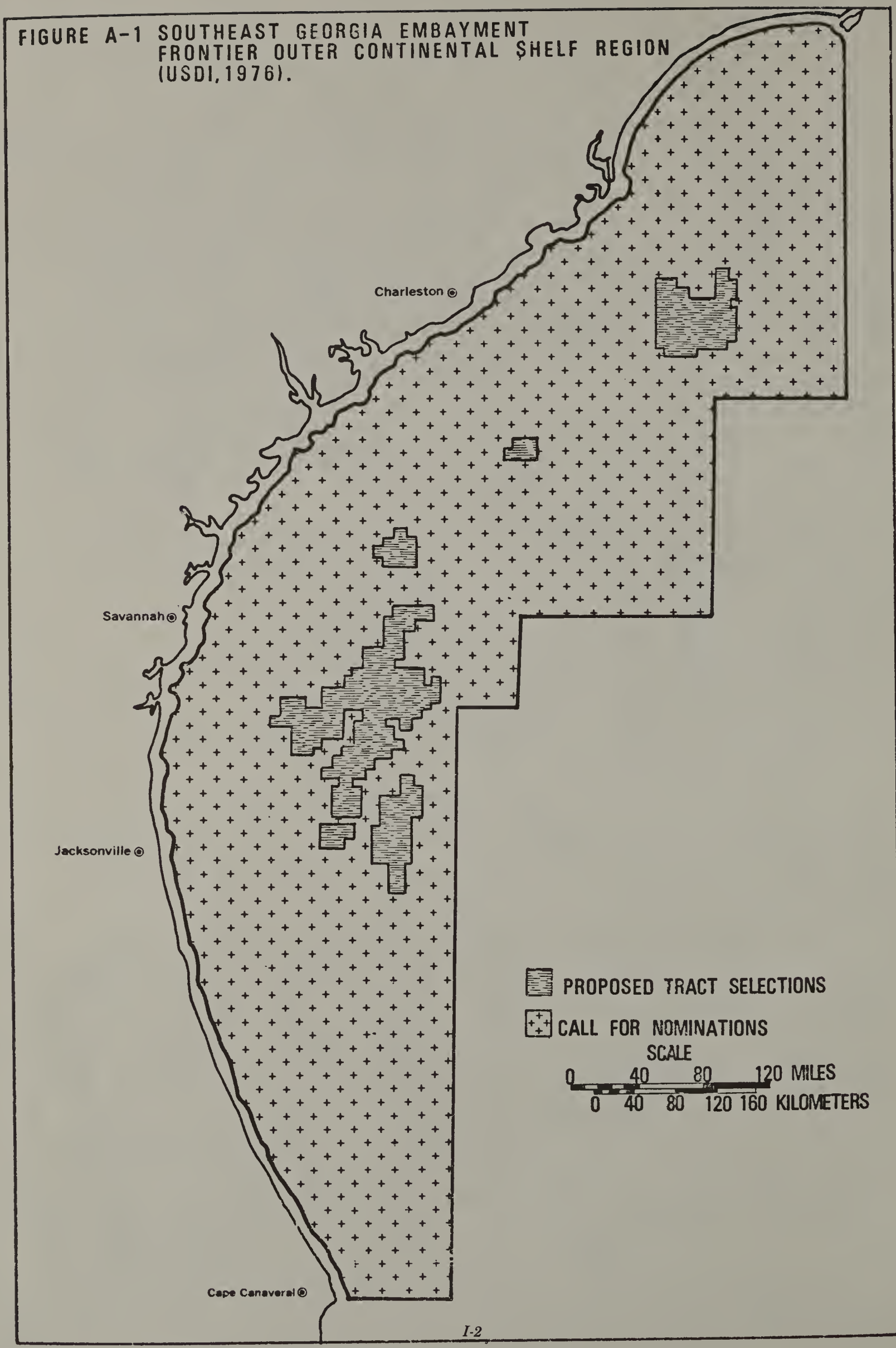
The Bureau of Land Management (BLM) requested resource reports on this area from other Federal agencies in May 1975. In September 1975, a Call for Nominations and Comments was issued (Appendix A). The call invited the oil and gas industry to nominate from within this area the blocks (each full block contains 2,304 hectares (5,693,184 acres), which it wished to be offered for lease. Interested parties, including state governments, were also invited by this call to identify blocks or areas which they felt should be withheld from leasing for environmental or other reasons.

The Call for Nominations and Comments for this South Atlantic proposal resulted in 778 tracts, with total area of approximately 1.8 million hectares (approximately 4.4 million acres) from the call area being nominated by nine companies.

The nominations and comments were evaluated by the New Orleans OCS Office, BLM and the Eastern Region Conservation Division of the U.S. Geological Survey (USGS).

Meetings at the field level were held in Atlanta in November and December 1975 to present and discuss the environmental and competitive aspects of the nominations. Participants in these meetings included Bureau of Land Management; Department of the Interior officials; Fish and Wildlife Service; Geological Survey; National Marine Fisheries Service; National Park Service; and representatives of the Governors and staff specialists from the states of North and South Carolina, Georgia and Florida. All participants were given an opportunity to make recommenda-

FIGURE A-1 SOUTHEAST GEORGIA EMBAYMENT FRONTIER OUTER CONTINENTAL SHELF REGION (USDI, 1976).



tions for or against offering blocks nominated in the call area.

The Washington headquarters' offices of BLM and GS met on February 17, 1976 to review the field level recommendation and develop the tentative tract selection to be approved by the Secretary. Representatives of the South Atlantic States were again invited to participate. Tentative tract selections were announced April 27, 1976. The 778 tracts nominated were reduced to 225 tracts for this proposed sale by removing from consideration 372 tracts that did not receive sufficient industry interest and 181 tracts that fell in areas of expressed environmental concern.

C. Activities Resulting from the Proposed Sale

The amount of commercial activity which may be generated in the U.S. South Atlantic region as a result of this proposed sale is dependent on many variables. Chief among them would be the availability of capital, manpower, equipment, and the amount of recoverable resources found as a result of the exploratory and development drilling. Distribution of recoverable resources, the ratio of oil to gas, geologic, economic, and other factors will affect the number of platforms, wells, and so forth needed to extract a given amount of resources.

1. Summary of Activities Expected to Result from the Proposed Sale

A detailed description of activities expected to result from proposed South Atlantic OCS Sale No. 43 may be found in Appendix B (USGS, 1976).

It is expected that exploratory drilling for oil and gas, conducted from mobile drilling rigs or ships, will commence within one year of the proposed sale date. Most of the exploratory drilling would probably take place in the first five years after the proposed sale date, and exploratory drilling could be completed within 14 to 16 years after the proposed sale. As set forth in 43 CFR Part 3302.2: "All oil and gas leases shall be issued for a term of 5 years and so long thereafter as oil or gas may be produced from the leasehold in paying quantities, or drilling or well reworking operations, as approved by the Secretary under 3305a.1 of this part, are conducted thereon."

Development well drilling, conducted from fixed platforms, could begin within five years of the commencement of exploratory well drilling, and continue for 8 to 12 years. Some service facilities onshore would be required to support exploration and development activities.

Production is expected to commence in 1982. Most platforms would be producing by 1988-91 and peak production may be attained in 1990. Since water depths of less than 200 meters are involved, conventional platforms are anticipated; gravity or concrete structures are not expected to be used. A detailed description of oil and gas operations may be found in Appendix C.

Due to the dispersion of tract locations in the proposed sale area, their distance from shore, and the modest production rates forecast, initial transportation of oil would be via tankers. Furthermore, unless or until strategically convenient deliverability of about 7×10^4 BOPD the construction of an oil pipeline to shore is doubtful because of the low resources anticipated, it is difficult to predict that more than two oil pipelines will be constructed. While a proposed stipulation (Section IV.E.) may reduce transportation of oil by barge from this proposed sale, initial dependence on tanker transport is foreseen for three to five years after production is commenced.

Using the empirical rule that a gas pipeline will be installed for each 7×10^5 MCFPD of deliverability, it is estimated that one to two gas pipelines may be installed.

If logistics and environmental conditions permit, it is conceivable that both oil and gas pipelines will utilize the same route to shore. As to the positioning and land fall for pipelines, it appears too conjectual to predict at this time.

No refinery is expected to be constructed in the U.S. South Atlantic region as a result of this proposed sale. Crude oil brought ashore in tankers or pipelines would be processed at existing facilities. The intercoastal tanker linkage of the U.S. South and Mid-Atlantic region could be utilized. Table C-1 indicates the area and range of activities and requirements expected to result from this proposed sale.

It is possible that this initial activity, if exploration is successful in finding resources, could result in future activities in this Southeast Georgia Embayment area that could extend exploration and development activities beyond the time frames discussed here. However, any additional lease sale proposals would be subject to separate environmental analyses at a later time, to consider

Table C-1 Area, Facilities and Activities Expected to be Required to Develop Hydrocarbon Resources Within the Proposed Sale Area based on USGS Estimates for this Proposed Sale. 1/

		Low Resource Estimate	High Resource Estimate
a.	Acres proposed to be offered	1,280,966 (518,400 ha)	
	Acres anticipated to be leased	740,114 (299,524 ha)	
b.	Wells		
	--exploratory	95	220
	--development (includes unsuccessful development wells)	160	500
	Total Wells	255	720
c.	Rigs (maximum working at one time)		
	--exploratory	5	12
	--development	8	15
	Total Rigs	13	27
d.	Platforms	10	25
e.	Offshore Pipelines		
	--oil	80 mi (129 km)	160 mi (257 km)
	--gas	80 mi (129 km)	160 mi (257 km)
	Total Pipelines	160 mi (257 km)	320 mi (515 km)
f.	Terminal/Storage Facilities 2/	1	2
g.	Onshore Operations Bases	1	2
h.	Gas Processing Plants (Units with capacity of 300 to 500 mmcf/d)	1	2
i.	Tankers (16,000 to 25,000 dwt)	3	6

1/ 0.282 to 1.009 billion barrels of oil and 1.890 to 6.810 trillion cubic feet of gas, based on USGS June 20, 1976 sale-specific estimates.

2/ Numbers of anticipated facilities are not necessarily proportional to the amount of estimated recoverable resources, because of differences in assumed development strategies and other assumptions.

Table C-1 (continued)

Estimated Total Weight (Tons) of Drill Cuttings (Average Well Depth 10,000 Feet)

	Low Resource Estimate	High Resource Estimate
Exploratory wells	64,790	150,040 tons
Development wells	109,120	341,000 tons
Total	173,910	491,040 tons

Estimated Total Weight (Tons) of Drilling Muds Retained in Well Bore, Adhering to Cuttings, or Entering Marine Environment (Unrecycled) 1/

Exploratory wells	21,850	220,000 tons
Development wells	36,800	500,000 tons
Total	58,650	720,000 tons

Estimated Total Volume of Formation Water Discharged
(Assumes a 1:1 ratio over field life)

0.3	1.0 billion barrels

Estimated Maximum Amount of Marine Sediment Disturbed by Pipeline Burial

1,280,000	2,560,000 yd^3

Estimated Land Use Requirements for Directly-Related Onshore Facilities 2/
(Excludes pipeline right-of-way)

	hectares (acres) number	
Onshore operation bases	20(50)1	60(150)3
Onshore oil terminals	16(40)1	32(80)2
Onshore gas processing plants	8(20)1	16(40)2
Total	44(110)	108(270)

1/ While it is not possible to estimate the relative amounts of drilling muds retained in the wellbore and amounts entering the marine environment, the bulk of unrecycled drillings muds is retained in the wellbore.

2/ Other land use requirements are discussed in Section III.E.2.

the impacts of further commitment to this U.S. South Atlantic area to oil and gas development.

2. Scope and Nature of Development Anticipated

The analysis of environmental impact undertaken by this EIS assumes the following scope and nature of the major action causing events to be associated with the sale: (1) an approximate 25 year period of development and production, (2) development based upon the high resource estimate (maximum case), (3) shore operation bases at Charleston, S.C. and Jacksonville, Fla., (4) tanker transportation up to 70,000 bbls/day of oil production and two oil pipelines after that level is exceeded, (5) product export from Jacksonville and Charleston to refineries in the Mid-Atlantic, Gulf of Mexico, or other areas by tankers.

The above assumed scenario could vary when it becomes more clear what resource potential exists and where it is located. Therefore, various possible scenarios to the above are examined further in Section III.E1. It should be recognized that they are assumptions about development possibilities and not alternatives plans of action just as the above is not a proposed plan of action. The above scenario of what development may entail should be regarded only as a judgement of what seems reasonably possible from what we know and can estimate today, projected into the future. Any specific plan of action cannot be formulated until a lease has been granted. Individual companies will have individual plans at that time which may differ or may approach the above scenario differently depending on who becomes the successful lessee, should the proposed sale be held.

3. Environmental Studies Program

The Bureau of Land Management has established broad objectives for environmental studies programs in order to satisfy various legislative requirements, including those of the Outer Continental Shelf Lands Act, the Submerged Lands Act, and the National Environmental Policy Act. These objectives are:

(1) The acquisition of information about the Outer Continental Shelf environment that will enable the Department and the BLM to make better management decisions regarding the development of mineral resources on the Federal OCS.

(2) The acquisition of information about the OCS environment which will enable the Department and the BLM to detect the impacts of OCS oil and gas exploration and development on the marine environment, and information which will enable the detection of environmental changes which may occur as a result of oil and gas operations.

(3) The establishment of a basis for prediction of impact of OCS oil and gas activities in frontier areas.

(4) The identification of sensitive habitats, potential geological hazards, and other factors of concern in the marine environment.

(5) The acquisition of impact data that may result in the modification of leasing stipulations, OCS Operating Orders, Notices to Lessees, and guidelines permitting efficient resource recovery while also insuring the protection of the marine environment.

The environmental studies program for the South Atlantic OCS is designed to acquire three distinct types of data: benchmark, descriptive and predictive. Benchmark data are both qualitative and quantitative data, for which an acceptable statistical significance can be established. These types of data are collected prior to oil and gas production so that any environmental impacts can be detected by monitoring the same parameters during the production stage. Descriptive data fall into two categories. The first is non-quantitative, or semi-quantitative descriptions of the morphological aspects of the environment which identify unique or special cases; the second is non-quantitative biological or chemical data for which statistical significance cannot be feasibly established. These data are primarily used in support of the analyses of effects which are observed through the benchmark and/or predictive data studied. They may also serve as indicators of environmental stress which could lead to the initiation of special studies designed to determine the sources and effects of the stress. Predictive information is primarily composed of physical processes data which can be used to determine the fate of pollutants, and biological effects data which can be used to predict and determine stress levels imposed by oil and gas development.

In order to fulfill its requirements under the marine minerals management goals of the Department of the Interior, the Bureau of Land Management has developed a comprehensive multi-year environmental study plan for the South Atlantic OCS area. This plan, which is entitled "Marine Environmental Study Plan for the South Atlantic

Outer Continental Shelf Area; Georgia Embayment and Blake Plateau Regions", was jointly prepared by the staffs of the New Orleans OCS Office and the Branch of Environmental Studies of the Washington BLM Office, and was released January 23, 1976. This document outlines the studies to be conducted in the South Atlantic OCS area; the data generated by these studies will represent an important addition to the existing data base and will enhance the Department's ability to make management decisions that will ensure environmental integrity during oil and gas exploration, development, and production in the area.

The studies program, as described in the study plan, is envisioned as a long-term study which will be in effect for a minimum of three to five years, and most likely will continue for the duration of exploratory and development drilling, establishment of production platforms, the laying of pipelines, and other related activities in the South Atlantic OCS area. Planning and budgeting have been based on an initial three-year period of intensive study, a slow decline in funding and effort over the succeeding two years; and a maintenance, or sustaining level of effort and funding for an indefinite number of years to monitor the effects of OCS oil and gas exploration and development over the long-term. Present estimates indicate that this monitoring period could range from five to fifteen years, but these estimates will continue to be revised depending upon the level of oil and gas activities that may occur in the region.

The studies program for the South Atlantic OCS area was formally initiated in the fall of 1975, with a conference/workshop conducted by the Research Triangle Institute, Inc., in Atlanta, Georgia, on October 14-17. The purpose of this workshop was to solicit recommendations from the scientific community, from conservationists, and from other interested parties, for the planning of studies to be conducted in the area. The results of this meeting are compiled and presented in the "Conference/Workshop Proceedings, Bureau of Land Management's Environmental Studies Program for the South Atlantic Outer Continental Shelf Area", released February, 1976.

Based upon the recommendations of this conference, and upon the recognized information needs of the BLM, the previously mentioned multi-year study plan and first-year statements of work were prepared which detail the studies to be conducted in the area; these planned studies are synoptically described below. The statements of work have been, or are being, converted to requests for proposals (RFP's), and have been, or will be, advertised in the Commerce Business Daily. Copies of the RFP's are available from the U.S. Department of the Interior, Bureau of Land Management, Branch of Contract Operations, Mail Stop 551, Interior Building, 18th and C Streets, N.W. Washington, D.C. 20240. Five RFP's are anticipated.

(1) Biological and Chemical Benchmark Studies (RFP No. AA550-RP6-20, issued June 11, 1976; proposals due July 30, 1976; contract AA550-CT7-2, issued November 15, 1976, to Texas Instrument, Inc.). Comprehensive benchmark studies designed to document the biological and chemical characteristics of the study area, and including elements of hydrocarbon and trace metal chemistry, benthic and water column biology, histology, microbiology, and program management.

(2) Geological Oceanography (RFP No. AA550-RP6-18, issued June 14, 1976, on a non-competitive basis to the U.S. Geological Survey, proposals due June 30, 1976; memorandum of understanding AA550-MU6-56, issued October 27, 1976). Detailed geological studies, including: sediment mobility; seston flux; vertical distribution of trace metals in sediments; sediment texture and composition studies; sea floor stability; and identification of outcrops and reefal structures.

(3) Physical Oceanography Field Studies (RFP No. AA550-RP7-1, issued November 1, 1976; proposals due December 10, 1976; anticipated contract issuance in January 1977). A major field study designed to describe the current circulation, surface movement, and mixing processes of the Georgia embayment.

(4) Physical Oceanography Literature Survey and Data Synthesis (RFP No. AA550-RP6-29, issued July 8, 1976; reissued November 2, 1976 as RFP AA550-RP7-7; proposals due December 3, 1976, anticipated contract issuance in January, 1977). A proposal requiring a comprehensive review of available published and unpublished data on the physical oceanography of the study area, including data processing so as to maximize the effective use of extant data.

(5) The Virginia Institute of Marine Science (VIMS) report update (RFP not issued at time of writing; anticipated contract issuance in early 1977). In 1973-1974 the Virginia Institute of

Marine Science (VIMS) prepared a comprehensive "Socioeconomic Environmental Baseline Summary for the South Atlantic Region, between Cape Hatteras, North Carolina and Cape Canaveral, Florida" for the BLM, under contract to the Council on Environmental Quality (CEQ contract EQ4AC007). That report consists of five volumes, dealing with physical oceanography, climatology, chemical and biological oceanography, geological oceanography, and a socioeconomic inventory. The present contract study will update the chemical, biological and geological oceanography section of the VIMS report.

It should be noted that the levels of funding and effort, the desired data products, and the timing of future studies may be modified in accordance with experience gained during the first year's study effort; this permits flexibility in selecting the parameters to be measured, the location of sampling stations, the evaluation of the contractors' performance, the evaluation of the data, the initiation of special studies, and other factors. Additionally, it must be emphasized that all funds are obligated on a year-to-year basis even though programs may be planned for longer periods of time.

A. SYNOPSIS OF SAMPLING AND ANALYSIS PROGRAMS

(1) Benthic, Biological and Chemical Program—(Contract AA550-CT7-2)—biological and chemical data, and supporting geologic data, will be collected by the contractor (Texas Instrument, Inc.) during the four biological seasons in the area. Samples will be collected from a total of fifty stations situated along seven transects. Samples will be collected and subsamples for the following analyses:

Geological and chemical analyses: Samples will be collected for trace metal, hydrocarbon and total organic carbon from each station; samples will be collected for granulometric (grain size) analysis from each box core sample taken, whatever the intended analysis.

Biological analyses: Samples will be collected for analysis of microfauna/meiofauna, microbiology, and macroinfauna. The micro-, meio-, and macrofauna samples are collected for taxonomic analysis, the microbial samples are collected for determination of the ratio of heterotrophic to hydrocarbon oclastic bacteria present, and for laboratory studies designed to assess the microbial hydrocarbon degradation "potential".

Biological and chemical analyses: Samples (macrobenthos including resident demersal fishes) will be collected from a maximum of twenty-five stations, using a trawl, dredge, or similar sampling gear. These samples will be used for taxonomic analysis, community characterization, chemical analyses (trace metal and hydrocarbon), and histopathological studies.

Photographic studies: Bottom photographs will be taken of the sites samples by the box corer, to supply additional information on the benthic environment, and to evaluate the representativeness of the site actually being sampled.

(2) Water Column Biological and Chemical Program (Contract AA550-CT7-2)—biological and chemical data, and supporting hydrographic data will be collected by the contractor (Texas Instrument, Inc.) during the four biological seasons in the area. Samples will be collected from a total of twelve stations located on the same seven transects as the benthic samples program. Samples will be collected using the most appropriate sampling gear, viz., plankton nets, niskin or nansen bottles, etc.

Hydrographic, water chemistry, and suspended sediment analyses: Samples will be taken for analysis of salinity, temperature, and dissolved oxygen with depth; dissolved micronutrients (nitrate, phosphate, silicate); chlorophyll *a*; particulate hydrocarbons; dissolved and surface film high molecular weight hydrocarbons; particulate and dissolved organic carbon; particulate trace metals; total (i.e., particulate plus dissolved) trace metals; suspended sediment granulometry; suspended sediment mineralogy; and transmissivity/nephelometry.

Biological analyses: Samples will be collected for analysis of water column microbes and of zooplankton. The effects of crude oil on microbial cultures and the microbial degradation of hydrocarbons will be studied; zooplankton samples will be analyzed taxonomically, and for hydrocarbon and trace metal levels.

(3) Geological Oceanography Program (Memorandum of Understanding AA550-MU6-56, effective October 27, 1976)—the following studies will be performed by the U.S. Geological Survey:

Sediment mobility study: Rates of sediment mobility will be determined in situ by deployment of three bottom-moored tripods seasonally; each tripod will be instrumented for detection of pressure, currents, transmissivity/nephelometry; and

inclination. The tripods will also be equipped so as to photograph the changes in surface bed forms and movements of bottom sediments with time, and to collected samples of sediment moving over the sea bed.

Seston flux study: Transmissivity/nephelometry studies will be conducted to determine the movements of suspended sediments in the study area.

Sediment sampling and analyses: Twenty Vibracores and ten hydrostatically damped gravity cores will be collected; these will be analyzed to determine the vertical distribution of trace metals in the sediments; also, granulometry, carbonate and organic carbon content, mineralogy, and paleontologic analysis of down-core sub-samples. Each of the cores will be x-radiographed and analyzed stratigraphically; age-dating will be performed on sediments from twelve of the Vibracores.

Sea floor stability studies: Geophysical surveys will be conducted using seismic reflection techniques to determine the locations of shallow and intermediate depth faults and locations of potential surficial sediment instability in the study area. Identification of outcrop and reefal structures: Surveys will be conducted using side scan sonar, precision depth recorder, and manned submersible dives to locate and define areas of outcrop and reefal structures.

(4) Physical Oceanography Field Studies—the physical oceanography study is expected to provide an understanding of the physical processes involved in the transport and dispersal of suspended or dissolved materials in Georgia Embayment waters sufficiently to parameterize these processes in descriptive models. Such models will permit a rational prediction of the probability of the paths along which potential contaminants associated with oil drilling may reach population centers or areas of biological importance, and the intensity of any environmental impacts arising from that. In conjunction with concurrent biological studies, the physical model aids in estimating the probability of contaminant effect on biological productivity of the continental shelf. It is expected that a period of three years, plus about one year for the production of a final report, will be required to achieve the program objectives. The following first year field study efforts are identified in light of existing knowledge, and with due regard to the limitation of resources available to support research:

Surface currents study: Using floating Lagrangian tracers and two anchored reference markers, drift patterns will be determined via synoptic aerial photography. This study will help define the surface transport across and/or along the turbid-clear water interface of the Georgia Embayment during both wet and dry seasons.

Subsurface currents study: Current measurements will be recorded over a three month period at several depths in the water column near the seaward end of one of the benchmark study transects. These data will be used to describe the short term variations in current profiles caused by Gulf Stream intrusions onto the shelf.

Hydrographic studies: Hydrographic data collected during the benchmark cruises (salinity, temperature, dissolved oxygen, nutrients, chlorophyll *a*) and geological cruises (transmissivity and suspended particulate material), and additional data from other sources (tides, river discharges, sea-level changes, satellite remote sensing, etc.) will be analyzed to characterize the physical system of the study area.

Meteorological and sea state data analysis: Analyses shall be conducted of all meteorological and sea state data collected by BLM supported cruises in the area; these data will be correlated with available meteorological and marine water/sea state data and predictions.

Shelf water and Gulf Stream variability study: Both hydrographic data and remote sensing imagery will be examined with respect to the interrelationship of the Gulf Stream and Georgia Embayment shelf waters.

Long-term current patterns study: One string of three or more continuously recording current meters will be moored near the shelf edge at about 32° 35' N latitude for one year. The data collected will be processed and interpreted to establish a mean and a range of variability of currents in the northern Georgia Embayment.

D. Relationship of This Proposed Sale to Development of Proposed OCS Planning Schedules for Possible OCS Oil and Gas Leasing and the Department's Program to Accelerate OCS Oil and Gas Leasing Nationwide

Proposed OCS Planning Schedules are developed in order to project the timing, size and location of specific lease sales for an OCS leasing

program. General sale areas are identified and, at a later date, tentative acreage figures are set through the tract selection process for each proposed sale on the basis of broad resource knowledge and environmental evaluation. The goal of the proposed schedule is to provide for orderly development of OCS oil and gas resources and to maintain an adequate contribution of OCS production to the national supply.

In developing a proposed OCS planning schedule the Department considers the three leasing objectives that have been set for the Departmental OCS program. These objectives are: (1) orderly and timely resource development; (2) protection of the environment; and (3) receipt of a fair return for leased mineral resources. One factor in planning for OCS leasing is to contribute to the domestic supply of oil and natural gas, consistent with the protection of environmental values. This is the basis for the existence of any OCS leasing program. Acreage is tentatively selected in sufficient amount to engender industry interest and promote a fair return.

The proposed OCS planning schedule is essential as a program planning document to enable the Department to proceed in an orderly and timely fashion with its process of considering the several proposed and possible lease sales identified in that document. The proposed OCS planning schedule aids the Department of the Interior in establishing the order in which areas will be examined and in planning the work assignments of personnel and the allocation of resources of the environmental and other studies enumerated. The proposed OCS planning schedule also serves to apprise Federal, State and local agencies, industry, and interested members of the public of the time frame for consideration of potential leasing in the identified areas of the OCS. The proposed OCS planning schedule is a flexible document that is subject to review and revision at any time. More particularly, the consideration of any proposed or possible sale is subject to being advanced, deferred, modified or terminated.

In May 1974, the Department announced that it would prepare a draft environmental impact statement on the proposed program to accelerate OCS oil and gas leasing from 1.2 to 4 million hectares (3 to 10 million acres) in 1975. This proposal considered the entire United States OCS. A draft environmental impact statement on this proposed program was published in October 1974, submitted to CEQ and made available to the public for review and comment. Public hearings were held in February 1975 on this draft statement in Anchorage, AK; Beverly Hills, CA and Trenton, NJ.

In November 1974, the Department modified the goal of its proposed accelerated OCS oil and gas leasing program nationwide from leasing four million hectares (1×10^7 acres) in 1975, to holding six proposed lease sales (a proposed sale refers to a tentative sale where tract selections have been made for the purpose of preparing a site-specific environmental impact statement) in 1975 and six possible lease sales (a possible sale, refers to a tentative sale which has been listed on the proposed OCS planning schedule but has not reached the tract selection stage of the consideration process) per year for the period 1976 through 1978, offering prospects in each frontier area (a frontier area refers to any of the 17 recognized OCS areas in which there has been no prior Federal oil and gas leasing) by the end of 1978. Accelerated leasing remained an integral part of the proposal, but the specific acreage figure had been eliminated.

The Department revised the content of the Draft OCS Programmatic environmental impact statement in light of the written comments received on that statement and oral comments submitted at the public hearings held in February 1975. A Final OCS Programmatic EIS was submitted to CEQ and made available to Federal, State and local agencies, and interested members of the public on July 7, 1975.

In September, 1975, the Department approved a program to accelerate oil and gas leasing on the Outer Continental Shelf. The Department's decision was made only after conducting in-depth studies based on the best information available considering environmental, technical and economic aspects of the proposal to accelerate OCS leasing.

On November 14, 1974, a proposed OCS planning schedule was announced by the Department of the Interior. The November 1974 proposed schedule was revised in June 1975, January and May 1977, to indicate changes in timeframes concerning possible or potential sales. Most recently, in August 1977, the Department of the Interior released a new Proposed OCS Planning Schedule (Figure D-1) which reflects changes in the timetables for consideration of certain possible sales and adds new possible sales for consideration through 1981.

Figure D-1

PROPOSED OCS PLANNING SCHEDULE

August 1977

SALE AREA	1977					1978											1979											1980											1981										
	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Cl Cook Inlet		N	S																																														
42 N. Atlantic	F		P		N	S																																												
43 South Atlantic-Georgia Embayment			F		P		N	S																																										
45 Gulf of Mexico				F		P		N	S																																									
65 Eastern Gulf of Mexico						E		H			F	P		N	S																																				
51 Gulf of Mexico							E		H			F		P		N	S																																		
49 Mid-Atlantic		T						E		H			F			P		N	S																																
48 Southern California												E		H				F		P		N	S																										
58 Gulf of Mexico			C		D		T						E		H				F		P		N	S																									
54 South Atlantic-Blake Plateau		C				D			T									E		H			F		P		N	S																				
Federal/State Beaufort (near shore)			C		D				T											E		H			F			N	S																			
55 Gulf of Alaska										C		D			T										E		H			F		P		N	S													
62 Gulf of Mexico														C		D			T							E		H			F		P		N	S											
46 Kodiak																												E		H			F		P		N	S									
52 North Atlantic																C		D			T							E		H			F		P		N	S									
53 Central and Northern California				C							D			T																	E		H			F		P		N	S							
60 Cook Inlet																C		D			T									E		H			F		P		N	S							
56 South Atlantic-Georgia Embayment																			C		D			T								E		H			F		P		N	S					
59 Mid-Atlantic																									C		D			T							E		H			F		P		N	S	
66 Gulf of Mexico																											C		D			T							E		H			F		P		N	S
57 Bering-Norton																				C							D			T								E		H				F		P		N	S

C - Call for Nominations
D - Nominations Due
T - Announcement of Tracts
E - Draft Environmental Statement
S - Sale
H - Public Hearing
F - Final Environmental Statement
P - Proposed Notice of Sale
N - Notice of Sale

Sales are contingent upon a reasonable assumption that technology will be available for exploration and development. A decision whether to hold any of the lease sales listed will not be made until completion of all necessary studies of the environmental impact and the holding of public hearings as a result of the environmental, technical, and economic studies employed in the decision making process, a decision may, in fact, be made not to hold any sale on this schedule

The Department of the Interior

This proposed OCS planning schedule does not represent a decision to lease in any of these particular areas. It represents the Department's intent to consider leasing in such areas and to proceed with the leasing and development of such areas if it should be determined that leasing and development would be environmentally, technically, and economically acceptable.

As in the case of the proposed South Atlantic OCS oil and gas lease sale No. 43, the Department has committed itself to preparing site-specific draft environmental impact statements on each oil and gas lease sale that may be proposed. This is in addition to the Final OCS Programmatic EIS and the approval of the OCS oil and gas leasing program. The Department is also committed to preparing development stage environmental statements should a lease sale be held and subsequent exploration prove successful.

In the planning for the accelerated leasing program, a request for comments from all concerned parties on potential OCS oil and gas leasing appeared in the Federal Register in February 1974. The Bureau of Land Management and the U.S. Geological Survey reviewed all the responses received, and on the basis of these responses, determined several rankings of the 17 OCS areas, including the South Atlantic, which were delineated in the request. The South Atlantic was ranked thirteenth among the 17 areas in a composite ranking according to its resource potential and preference. Four petroleum companies also ranked the 17 areas on the basis of environmental hazard. From least to greatest hazard, on a scale of one to ten (ten being greatest hazard), the South Atlantic was given a ranking of five (USDI-BLM, 1974a). Detailed analyses of the factors affecting this environmental ranking were not provided. This request for comments and ranking procedures was the first tier in the two-tier nomination system for OCS leasing, the second procedure being the tract selection process.

The Council on Environmental Quality (1974a) ranked the Atlantic and Gulf of Alaska OCS areas for environmental hazard. From the least to greatest hazard, CEQ placed the southeast Georgia Embayment as the most hazardous of six generalized areas in the Atlantic, just ahead of the Gulf of Alaska in environmental hazard.

E. Relationship to Other Governmental Programs

1. Federal

A. ADMINISTRATIVE AND REGULATORY RESPONSIBILITIES

As indicated in Section I.B., pre-leasing evaluations and analyses and leasing procedures are the responsibility of the Department of the Interior—primarily the Bureau of Land Management and the U.S. Geological Survey. The U.S. Fish and Wildlife Service helps design environmental studies and acts in an advisory capacity through much of the leasing process.

Several agencies, including Interior agencies, are involved in regulatory aspects of offshore oil and gas operations which involve their program areas. Offshore structures require permits to assure that navigation is unobstructed (permits are issued by the Department of Defense, Secretary of the Army, Corps of Engineers), and to ascertain that structures are properly marked to protect navigation (permits are issued by the Department of Transportation, U.S. Coast Guard). Establishment and enforcement of navigational safety is also a responsibility of the U.S. Coast Guard. Pipeline safety is regulated by the Materials Transportation Bureau (MTB) in the Department of Transportation. In May 1976, the Secretary of the Interior and the Secretary of Transportation signed a Memorandum of Understanding (MOU) regarding pipeline safety regulations on the OCS. This MOU specifies each agency's individual responsibilities for pipeline safety supervision and their joint responsibilities for inspection, enforcement, and coordination. The U.S. Geological Survey considers safety features of design specifications in approving applications (Appendix D), and regulates other aspects of oil and gas development through the OCS operating orders (Appendix G) and notices to lessees and operators. BLM grants the rights-of-way for pipelines through the Federal OCS region.

The Federal Power Commission (FPC) and Interstate Commerce Commission (ICC) regulate pipelines linked to interstate commerce, and the FPC sets the wellhead price of OCS-produced gas.

Permits for and regulation of oil discharges are under the jurisdiction of the Environmental Protection Agency (EPA), by the authority of the Federal Water Pollution Control Act (FWPCA),

as amended in 1972 (33 U.S.C. 466; 86 Stat. 816). The FWPCA established a National Pollutant Discharge Elimination System (40 CFR 125, 38 F.R. 13528). This system applies to discharges from any point source and requires a permit from EPA for the discharge of any pollutant as defined by the Act. Interim standards limit discharges to 30 mg/l not to exceed 50 mg/l on any one day. Discharges of pollutants without the necessary permit from EPA are unlawful. In accordance with the same Act, the U.S. Coast Guard approves the procedures followed and the equipment used for the transfer of oil from vessel to vessel and between onshore and offshore facilities and vessels. The Coast Guard conducts pollution surveillance patrols to detect oil discharges within territorial and contiguous waters and occasionally within 50 miles of land. The Geological Survey perform surveillances for oil spills and discharges along pipeline routes from offshore to onshore facilities. The FWPCA also provides for a National Oil and Hazardous Substances Pollution Contingency Plan for which EPA and the Departments of Interior, Transportation, and Defense will share responsibility.

In addition, an OCS Advisory Board has been established pursuant to the provisions of the Federal Advisory Committee Act and under the authority of the OCS Lands Act of 1953. The objective of the Board is to advise the Department of the Interior in the performance of discretionary functions under the OCS Lands Act. These functions include all aspects of exploration and development of OCS resources, for example, resource evaluation, environmental assessment, leasing, mitigating of adverse impacts, and development plans. In formulating recommendations the Advisory Board shall, as applicable, request advice from the OCS Environmental Studies Committee.

The Advisory Board is chaired by the Secretary of the Interior or his designee and membership consists of one representative from the following: Department of State, Environmental Protection Agency, Federal Energy Administration, Council on Environmental Quality, and the U.S. Departments of Commerce, Defense, and Transportation. In addition, one representative from each of the 22 coastal States plus Pennsylvania are members of the Advisory Board.

The OCS Environmental Studies Advisory Committee was created pursuant to the provisions of the Federal Advisory Committee Act and under the authority of the OCS Lands Act. This Committee advises the Department of the Interior on the design and implementation of studies related to oil and gas exploration and development on the OCS. These studies include baseline or benchmark data collection, evaluation, monitoring and special studies. The committee will serve as the scientific counterpart of the OCS Advisory Board.

The Committee is chaired by a Department of the Interior scientist, designated by the Assistant Secretary, Land and Water Resources, and membership consists of one representative each from the Environmental Protection Agency, National Oceanic and Atmospheric Administration, National Science Foundation, the U.S. Coast Guard, U.S. Geological Survey, U.S. Fish and Wildlife Service, and the Bureau of Land Management. In addition, each of the 22 coastal states, plus Pennsylvania, similar to the Advisory Board, will have one appointed member on the committee. To achieve a balance of views the Secretary of the Interior can appoint not more than six scientists from the private sector to the committee.

The Fishery Conservation and Management Act of 1976 (P.L. 94-265) established a 200-mile fisheries conservation zone off the coasts of the U.S. and its possessions, effective March 1, 1977. The Act provides for creation of Regional Councils to be composed of individuals representative of State and Federal interest responsible and concerned for commercial and recreational fisheries in the marine environment. Administered under the Department of Commerce, the National Marine Fisheries Service will assist the Regional Councils in developing fishery management plans inclusive of the outer continental shelf in the South Atlantic. The South Atlantic Fishery Management Council will develop the fisheries plan for the marine environment corresponding to the offshore area under study for proposed OCS Sale 43. This plan will serve as a basis for policy and management decisions relating to fisheries in the South Atlantic.

A more complete discussion of the regulatory authorities and supervision provided subsequent to lease has been included in Section IV.

Table E-1 is a listing of authorities considered in the preparation of BLM environmental statements.

Table E-1. Listing of Authorities Considered in the Preparation of BLM Environmental Statements.

Major Statutes:

National Environmental Policy Act of 1969 (42 U.S.C. 4321).
Clean Air Act, as amended (42 U.S.C. 1857h-7).
Federal Water Pollution Control Act, as amended (33 U.S.C. 466).
Solid Waste Disposal Act, as amended (42 U.S.C. 3254).
Noise Pollution and Abatement Act of 1970 (43 U.S.C. 1858).
Fish and Wildlife Coordination Act (16 U.S.C. 661).
National Historic Preservation Act of 1966, as amended (16 U.S.C. 470).
Department of Transportation Act of 1966 (49 U.S.C. 1651).
Coastal Zone Management Act of 1972 (16 U.S.C. 1451-1454).
Estuary Protection Act of 1968 (16 U.S.C. 1221-1226).
Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271).
Water Quality Act of 1965 (33 U.S.C. 1151) and Water Resources Planning Act (42 U.S.C. 1462).
Intergovernmental Cooperation Act (40 U.S.C. 531 and 42 U.S.C. 4201).
Antiquities Act (16 U.S.C. 431-33).
Taylor Grazing Act of June 28, 1934, as amended (43 U.S.C. 315-315m, 315r-315o-1).
Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 et.seq.)
Federal Coal Leasing Amendments Act of 1975 (30 U.S.C. 201-202a, 208-1).
Endangered Species Act of 1973 (16 U.S.C. 668aa).
Outer Continental Shelf Lands Act of 1953 (76 Stat. 462; 43 U.S.C. Sec. 1337).
Fishery Conservation and Management Act of 1976 (P.L. 94-265).

Executive Orders

Executive Order 11296 Flood Plain (August 10, 1966).
Executive Order 11507, Control of Air and Water Pollution at Federal Facilities (February 4, 1970).
Executive Order 11514, Protection and Enhancement of Environmental Quality (34 F.R. 4247, March 5, 1970).
Executive Order 11593, Protection and Enhancement of Cultural Environment (36 F.R. 8921, May 13, 1971).

Other Authorities

Departmental Manual 135.1-3 and 516.1-3.
Intensity of Use and Management of Lands Retained for Multiple Use Management, 43 CFR 1724.3-2.
Bulletin No. 72-6, Office of Management and Budget (September 14, 1971).
Guidelines of the Council on Environmental Quality (F.R. Document 73-15783, July 31, 1973, Volume 38, Number 147).
OMB Revised Circular A-95, Evaluation, Review and Coordination of Federal and Federally Assisted Programs and Projects (January 1, 1974).
Secretarial Order No. 2974.

Table E-1 (continued)

Other Relevant Statutes:

O and C Act of August 8, 1937 (43 U.S.C. 1181 a).
Material Sales Act of July 31, 1947 (43 U.S.C. 1185).
Wild Free Roaming Horse and Burro Act of 1971 (16 U.S.C. 1331).
Archaeology and Historic Preservation Act of 1974 (16 U.S.C. 469-469c).

B. OTHER FEDERAL ACTIVITIES ON THE SOUTH ATLANTIC OCS

Principal military uses of the South Atlantic OCS are by the Navy and Air Force. Operations are conducted for training and support of national defense interests. Exercises include surface and aerial gunnery, bombing, torpedo firing; air-to-air, air-to-surface, and surface-to-surface missile firings; air combat maneuvering; aircraft carrier operations; and surface ship and submarine training.

Launching of space and test vehicles from Cape Kennedy Space Center by the National Aeronautics and Space Adminstration creates a major hazard zone during these activities.

2. State

While the Department of the Interior has diverse leasing, regulatory and other responsibilities with regard to OCS oil and gas development activities, and while these activities influence onshore development, onshore OCS-related development would be guided and controlled by State and local regulations and legislation. Interstate transmission and sale of oil or gas falls within those activities covered by the commerce clause of the Constitution and is therefore subject to ultimate control and regulation by the Federal govermnent. Although states and other local governments are not precluded from imposing reasonable and non-discriminatory restraints and restrictions on interstate commerce, such exercise of police power, however, must not have the effect of placing a substantial burden on such interstate commerce. The extent of control or affect that states and local governments can extend over activities falling under the definition of interstate commerce becomes a question of fact which depends upon the circumstances of each particular case. The tentative conclusion can be drawn that states and local governments can affect interstate pipelines so long as the action is non-discriminatory, does not impose an undue burden on the operation of the pipeline and is reasonably related to a legitimate governmental purpose which is within the jurisdiction of such governing body. Probably, the degree of state and Federal jurisdiction would have to be established by looking at all the circumstances then existing. Following is a discussion of State programs and legislation which may be affected by or will affect onshore OCS-related activities.

A. COASTAL ZONE MANAGEMENT

The Coastal Zone Management (CZM) Act of 1972 (16 U.S.C. 1451-1464) as amended, administered by the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce, provides grants-in-aid to States for the development and implementation of management programs to control land and water uses in their coastal zone. Program development grants are made on an annual basis for up to four years (this authority expires on September 30, 1979). Also within this time frame, supplementary grants may be given before final approval of the CZM Plan is complete. After Secretary of Commerce approval of the CZM Plan, administrative grants will be awarded for its implementation. The policy which the Act established is aimed at balancing protection of the coastal environment with development and economic interests.

The CZM Act requires that Federal action within the coastal zone must be consistent. To the maximum extent practicable with a state's CZM program once that program has been approved by the Secretary of Commerce. Conversely, state CZM plans must consider the national interest in facility siting. Local governments in turn must consider state and regional interests in the exercise of their coastal regulatory powers.

Under the consistency provision of the Act, exploration and development plans of OCS oil and gas lessees will receive consistency review by affected coastal states with approved management plans.

While the Act allows individual States much leeway in devising management plans and allocating responsibilities, both among State agencies and to regions and localities, the States have the final say in the Plan. Therefore, the types of development permitted in the coastal zone, including any that might be associated with offshore oil and gas operations in the event this proposed sale is held can ultimately be broadly influenced or controlled by the State programs and policies.

Section 308 of the CZM Act, as amended, outlines the Coastal Energy Impact Program (CEIP) which provides financial assistance, in the form of loans, bond guarantees, and grants, to help coastal states and local communities affected by new or expanded coastal energy activity.

The two sources of financial assistance are the Coastal Energy Impact Fund (Section 308(h)) authorizing $800 million over ten years and For-

mula Grants (308(b)) authorizing $400 million over eight years. Fund monies can be awarded for any coastal energy activity. Formula Grant monies must be awarded for impacts sustained primarily from OCS energy activity.

To be eligible for assistance under the CEIP, a coastal state must be receiving a grant under Section 305 of the Act or have a coastal management program which has been approved under Section 306 of the Act, or be making satisfactory progress toward the development of a program which is consistent with the policies set forth in Section 305 of the Act.

Assistance under the CEIP can take four possible forms: First, grants for planning for socioeconomic and other environmental consequences of oncoming energy activity can be provided. Second, the CEIP can help finance new or improved public facilities and services needed because of further coastal energy development. Third, repayment assistance can be provided when a borrowing government cannot meet its credit obligations because actual revenues from coastal energy activity are insufficent. And fourth, grants may be provided to ameliorate damage to recreational or other environmental resources when the responsible party cannot be found or charged with damage.

OCS energy activity, including that which may result from proposed lease sale No. 43, will undoubtedly lead to requests for financial assistance. This will take any of the four forms mentioned above and will be the result of either direct or indirect impacts of OCS activity. Interim-final regulations and rules of Coastal Energy Impact Program (CEIP) implementation became effective February 4, 1977 and will remain in effect until superceded by final regulations to be issued by the Department of Commerce.

No State adjacent to the proposed sale area has completed or received Secretary of Commerce approval of its Coastal Zone Management Plan. Expected completion dates are discussed for each state in the following pages. The final approved CZM plans of North Carolina, South Carolina, Georgia, and Florida are not expected to totally prohibit OCS related developments in the coastal zone. These States have expressed support for OCS energy development if sufficient safeguards for the environmental, social, and economic well-being of the adjacent coastal region is provided. State CZM plans may restrict the placement of pipelines, refineries or other support facilities in areas of particular environmental concern and set standards for their placement elsewhere, however, some provision for their appropriate location is required by the CZM Act as amended.

B. STATE LEGISLATION AND REGULATION

At the present time the siting, construction and operation of OCS-related facilities onshore would be subject to a variety of state and local regulations for each state in the proposed sale area, the following discussion describes the status of Coastal Zone Management planning and briefly identifies existing state and local legislation most pertinent to OCS developments.

North Carolina

North Carolina's Coastal Area Management Act was passed in 1975 and provides the authority to place into effect the Coastal Area Management Plan. The development of this plan is under the direction of the North Carolina Resources Commission and it is expected to be submitted to the Secretary of Commerce for approval in mid-1977 with possible approval by Spring of 1978. Additional statutes and regulations relating to OCS activities which are either in effect or presently under consideration are listed below:

(1) Local Land Use Plans—completed for all participating coastal communities and counties except one.
(2) State Energy Policy Act—in effect.
(3) Area of Environmental Concern Plans and Regulations—under study.
(4) Areawide Waste Treatment Management Plans—under study.
(5) Air and Water Pollution Regulations—in effect.
(6) Geophysical Exploration Act and Regulations—in effect.
(7) Oil and Gas Conservation Act and Regulations—in effect.
(8) Disposition of Mineral Deposits on State Lands Under Water—Act and regulations in effect.

South Carolina

South Carolina has not yet enacted legislation to implement a coastal zone management plan although the Governor has appointed a Coastal Zone Planning and Management Council to draft such legislation. The planning effort under Section 305 of the CZM Act was recently extended by the Governor to September 1977 to allow for development of the plan and the establishment of the legislative base.

At present, development control below the mean high water line in South Carolina is partially Federal, in the form of U.S. Army Corps of Engineers permits. In addition to comments solicited

from other Federal agencies, the Corps requests state comments from the South Carolina Water Resources Commission. The Commission gathers comments from concerned state agencies and the response to the Corps is coordinated through the South Carolina Budget and Control Board.

Within the Coastal Zone, Horry, Georgetown, and Charleston Counties have adopted land use zoning ordinances, and Georgetown, Charleston and Beaufort have adopted Subdivision Regulations.

The South Carolina Wildlife and Marine Resources Department is making a study of present state laws affecting the coastal zone to support the coastal zone management plan.

Georgia

The Governor's Office of Planning and Budget is responsible for coordinating the Coastal Zone Management Program in Georgia. It is expected that this program will be adopted by Spring of 1979.

At present at least nine state laws regulate activities in Georgia's coastal zone. These laws are listed below:

(1) Oil, Gas, and Other Minerals Drilling Act.
(2) Coastal Marshlands Protection Act, as amended.
(3) Water Quality Control Act, as amended.
(4) Air Quality Control Act, as amended.
(5) Groundwater Use Act, as amended.
(6) Georgia Health Code (including Rules and Regulations for Water Supply Quality Control and Rules and Regulations for Individual Sewage Disposal Systems).
(7) Solid Waste Management Act, as amended.
(8) Surface Mining Act, as amended.
(9) Erosion and Sedimentation Control Act.

The Coastal Marshlands Protection Act is particularly important with regard to state control of potential OCS related facilities. The act provides that "no person shall remove, fill, dredge, or drain or otherwise alter any marshlands in this State within the estuarine area thereof without first obtaining a permit from the Department of Natural Resources" (Georgia Laws 1970, p. 939 and as amended).

Georgia coastal counties have established a number of land use regulations which are relevant to potential OCS developments. Zoning regulations exist in Chatham, Bryan, Liberty and Camden Counties. Subdivision regulations are in effect in Chatham, Bryan, Liberty and Camden Counties and are pending in Glynn County. Building permits are required by Chatham, Bryan, Liberty and Glynn Counties. A sand dune ordinance is in effect in Glynn County and is pending in Chatham, Bryan and Liberty Counties. (Georgia Department of Natural Resources, Handbook: Building in the Coastal Environment, June 1975.)

Florida

Under the new CZM Act Amendments, Florida expects to receive Secretary of Commerce approval of their CZM plan by September 1978. The plan is under development by the Bureau of Coastal Zone Management within the Florida Department of Natural Resources. The State already has extensive authority to regulate activities within its coastal zone although these powers are contained in a number of legislative acts and are administered by several state agencies.

The Florida Department of Natural Resources, Bureau of Coastal Zone Planning has identified 24 laws which bear in some degree upon activities and developments within the State's coastal zone (Suggested State Policy and Criteria for Coastal Management in Florida, Preliminary Draft October 1, 1976).

Two of these may have particular significance to OCS development.

Local Government Comprehensive Planning Act of 1975, Chapter 163.3161-163.3211 F.S.

Requires mandatory comprehensive planning by cities and counties by 1979. This act is particularly significant to OCS impact planning because it provides that counties, municipalities, and certain other units of local government are required by July 1, 1979, to prepare and adopt comprehensive plans for guiding future development. Among the act's required planning elements are: future land use (Section 7(6)(a)), conservation (Section (6)(d)), recreation and open space (Section 7(6)(c)), intergovernmental coordination (Section 7(6)(h)), and where appropriate, coastal protection (Section 7(6)(g)). Local plans adopted in accordance with provisions of the act have the force of law and are binding upon future actions of local government.

The Florida Environmental Land and Water Management Act of 1972, Chapter 380, F.S.

Provides for the accomplishment of proper state land and water management policies through the coordination of local decision-making and actions relating to growth and development. Plans for developments which will have regional impact must be reviewed and approved by the affected Regional Planning Council.

F. Legal and Administrative Background

In 1953, the Outer Continental Shelf Lands Act (67 Stat. 462) established Federal jurisdiction over the submerged lands of the Continental Shelf seaward of the state boundaries (usually the three-mile limit of the territorial seas). Federal jurisdiction of the OCS beyond the three-mile limit on the Atlantic coast was upheld in March 1975, in the Supreme Court decision U.S. vs. Maine, 420 U.S. 515 (43 L.ED.2nd 363). The OCS Lands Act charged the Secretary of the Interior with the responsibility for administration of mineral exploration and development on the OCS. It also empowered the Secretary to formulate regulations so that provisions of the Act might be met.

Subsequent to the passage of the OCS Lands Act of 1953, the Secretary of the Interior designated the Bureau of Land Management (BLM) as the administrative agency for leasing submerged Federal lands, and the Geological Survey for supervising operations. The Department formulated three major goals for the comprehensive management program of marine minerals. These are:

(1) The orderly development of marine mineral resources to meet the energy demands of the nation.
(2) The protection of the marine and coastal environment.
(3) The receipt of a fair return for the leased mineral resources.

These leasing objectives are based on legislative mandates as explained below.

(1) Orderly resource development is based on the OCS Lands Act which gives the Secretary the authority, in order to meet the demand for oil and gas, to grant leases to the highest qualified bidder(s) on the basis of sealed competitive bids.

(2) The policy of protection of the marine and coastal environment is a direct outgrowth of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.). This Act requires that all Federal agencies shall utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences in any planning and decision-making which may have an impact upon the environment. Responses to these requirements by BLM include the formation of Environmental Assessment Teams, development of Environmental Impact Statements (EIS's), and sponsorship of contract studies. These studies include environmental benchmark studies, monitoring, and special studies designed to provide information for assessing the effects of oil and gas operations.

(3) Receipt of a fair return has its basis in two separate mandates. United States Code 31, Sec. 483(a) obligates the Federal Government to obtain a fair return for public lands that are sold or leased. This is further implemented within the Executive Branch by the Office of Management and Budget Circular A-25.

Section 2

Description of the Environment

A. Geologic Framework

1. Introduction

The region under consideration will cover the coastal portions of the states of North Carolina, South Carolina, Georgia and Florida and encompasses the coastal plain, continental shelf, Blake Plateau and portions of the Blake-Bahama Basin of the Atlantic Ocean. Visual No. 2 N-S shows geologic and geomorphic information for this region.

The major feature of interest here is the Southeast Georgia Embayment which is bounded on the north by the Cape Fear Arch, on the south by the Florida Peninsular Arch and opens seaward toward the Blake Plateau. The origin of these features is complex; however, this description is simplified by using the concepts of continental drift and sea floor spreading. Contributions by Wilson (1966), Bullard et al. (1965) and Olson and Leyden (1973), contend that the Atlantic Ocean became closed in late Paleozoic time (Table A-1) and by the late Triassic period had formed a new rift zone which joined a series of salt basins from the Gulf of Mexico (Louann Basin) to the Proto-Mediterranean Sea. The brine in the sea is proposed to have been ten times the present salinity of sea water.

Plate boundaries, crustal blocks and magma bodies emplaced along linear features have caused prominent gravity and magnetic anomalies in the area. Some of the gravity and magnetic anomalies may be traced to post-Triassic magma emplacements; however, the most prominent features, the East Coast Magnetic Anomaly, about 100-200 gammas, (Drake et al., 1963 and Taylor et al., 1968) correlates with the edge of the continental margin north of Cape Hatteras, divides south of Hatteras with one positive limb trending under the Blake Plateau, and the prominent positive-negative anomaly extends westward crossing the coast at Brunswick, Ga. and continues inland. The positive free-air gravity anomaly also trends along the shelf slope boundary dividing at 31° N. latitude (Rabinowitz, 1973). One branch follows the magnetic anomaly across Georgia and the other branch continues along the edge of the shelf off Florida (Figure A-2). Long (1974) infers that the anomalies across Georgia may be old plate boundaries reflecting collision or separation between the plates. Suggestions have been made that the southern Georgia-Florida and Blake-Bahama blocks were added to the paleocontinent to the north in pre-Paleozoic time.

Sea floor spreading which commenced in the Mesozoic era opened the Atlantic Ocean (Figure A-3). Heavy loads of sediment began to cover the crusted blocks between the continental and Blake Escarpment blocks (Figure A-4). Upper Cretaceous and Tertiary sediments have spilled over the Blake Escarpment Block into the Blake Bahama Basin. Details of this sedimentation are shown by Emery and Zarudzki (1967). They constructed a structural profile from seismic reflection data which consisted of six JOIDES (Joint Oceanographic Institutions Deep Earth Sampling) holes drilled to the Eocene and two coastal plain holes with hole B drilled as deep as the Cretaceous period (nearly 1 km in depth). The location of JOIDES holes J1 through J6 are shown on Visual No. 2S. The USGS has just begun a core hole drilling program along the Atlantic OCS. Four holes are planned for this area and are plotted on Visual No. 2 N-S. Recently the U.S. Geological Survey has collected a series of Common Depth Point (CDP) seismic profiles across the Georgia Embayment and Blake Plateau.

2. Physiography of the Continental Shelf and Slope

The continental shelf ranges from 33 km in width at Cape Hatteras to a maximum width of 135 km between Charleston, S.C. and Jacksonville, Fla. at the Florida Escarpment. The depth of the shelf break between Cape Romain and Cape Canaveral is between 50 and 70 m (Uchupi, 1967). The shelf surface is irregular, and sand ridges are aligned at right angles to the shoreline (Figure A-5). As many as seven terraces or submerged shores have been recognized from echo sounding data on the shelf between Miami and Cape Hatteras; one of these terraces is as deep as 120 m, well below the shelf break (Dillon et al., 1975).

Numerous patch reefs dot the shelf, particularly in Onslow Bay (MacIntyre, 1970, Figure A-6). Some are considered projections of a Miocene marl overlain by a great variety of encrusting calcareous organisms (Dillon et al., 1975). Other reefs, such as Gray's Reef (Hunt, 1974), are dated as Pliocene. More extensive areas of hardbanks, known as the inner, middle and outer banks, are shown on Visual No. 2 N-S. The inner banks are the least extensive and are found near Jackson-

Table A-1. Geologic Time Chart. From Data in Braziunas, T. 1975. A geological duration chart, Geology, 3(6): 342-343.

	AGE DIVISIONS		TIME			
	ERA		DURATION IN MILLIONS OF YEARS			BEGINNING MILLIONS OF YEARS AGO
	PERIOD		ERA	PERIOD		
		EPOCH			EPOCH	
CENOZOIC	QUATERNARY	RECENT	70.011	1.011	0.011	0.011
		PLEISTOCENE			1	1
	TERTIARY	PLIOCENE			9	10
		MIOCENE			15	25
		OLIGOCENE			15	40
		EOCENE		69	20	60
		PALEOCENE			10	70
MESOZOIC	CRETACEOUS		160	60		130
	JURASSIC			50		180
	TRIASSIC			50		230
PALEOZOIC	PERMIAN		370	40		270
	PENNSYLVANIAN			64		334
	MISSISSIPPIAN			16		350
	DEVONIAN			50		400
	SILURIAN			40		440
	ORDOVICIAN			60		500
	CAMBRIAN			100		600
PRE-CAMBRIAN	GRENVILLE OROGENY		4000			1000
	OLDEST KNOWN ROCKS IN NORTH AMERICA					3200
	OLDEST KNOWN ROCKS (MURMANSK AREA)					3400
	PROBABLE AGE OF EARTH					4600

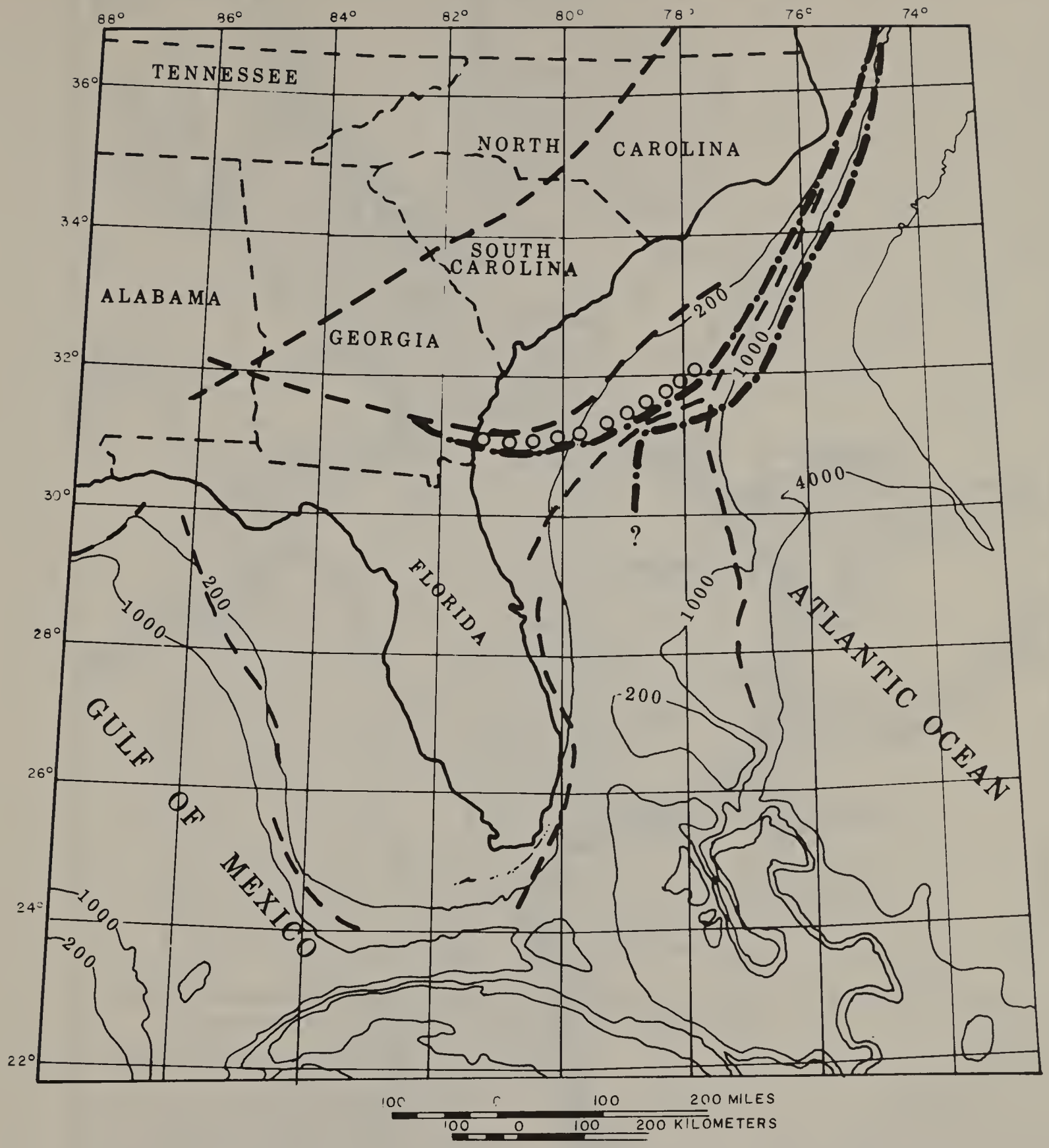


Figure A-2 Major gravity and magnetic anomaly trends

--- positive free-air gravity greater than 20 mgal

-.-.- positive total intensity magnetic anomaly 150-250 gammas, running along the shelf edge and along the Appalacians

ooooo prominent negative magnetic anomaly into Georgia

Source: Dillon et al., 1971

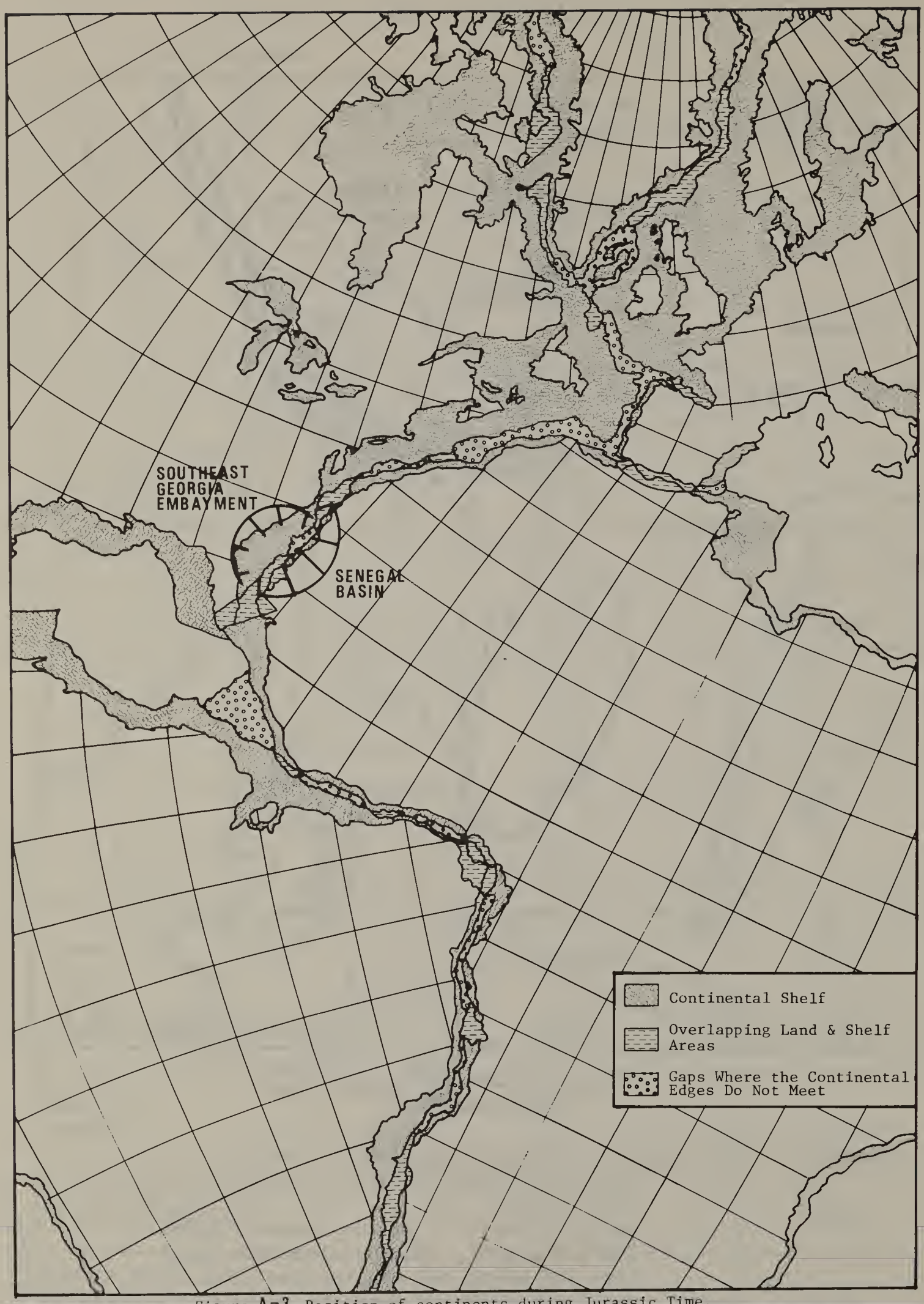
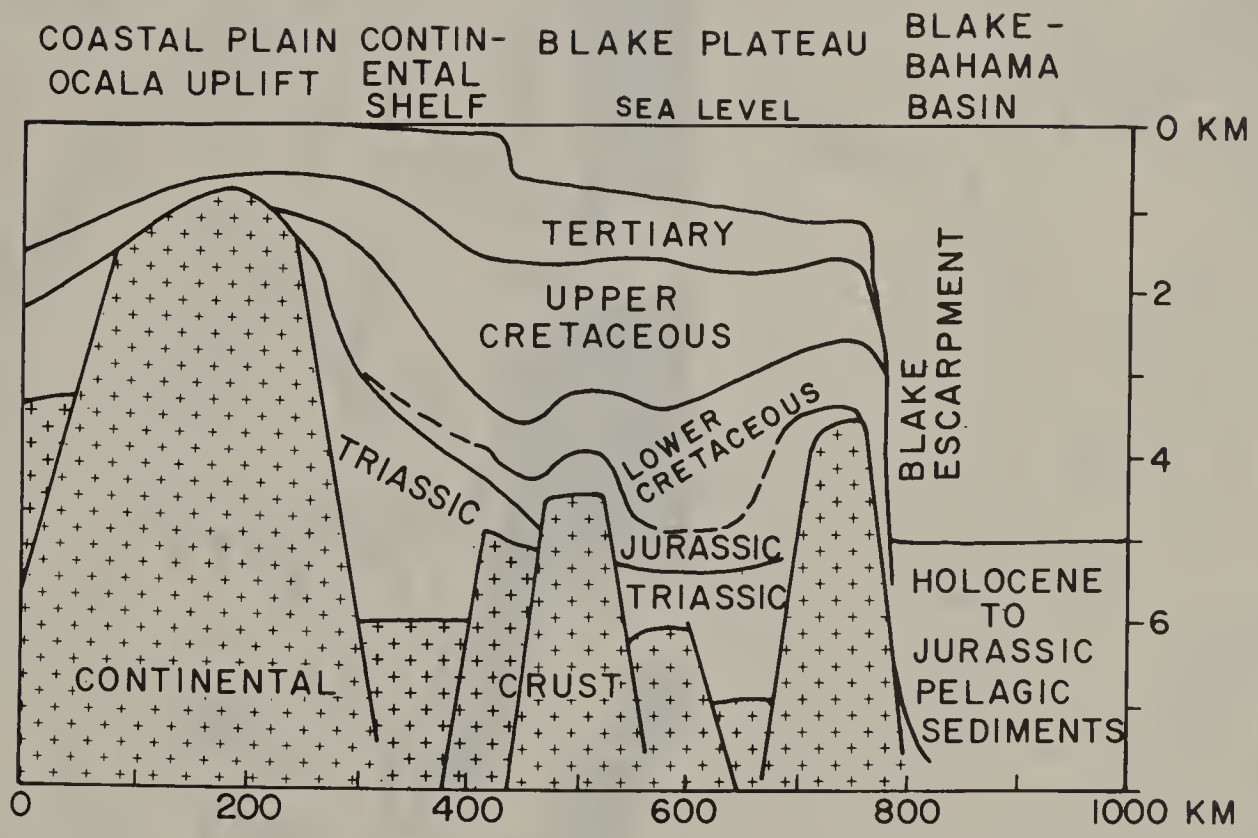


Figure A-3 Position of continents during Jurassic Time.
170 million years before present.
(After Briden, Drewry, and Smith, 1974).



FIGA-4 Schematic east-west section across Florida coastal plain and Blake plateau in latitude of Jacksonville showing hypothetical deep structures. (OLSON, 1974)

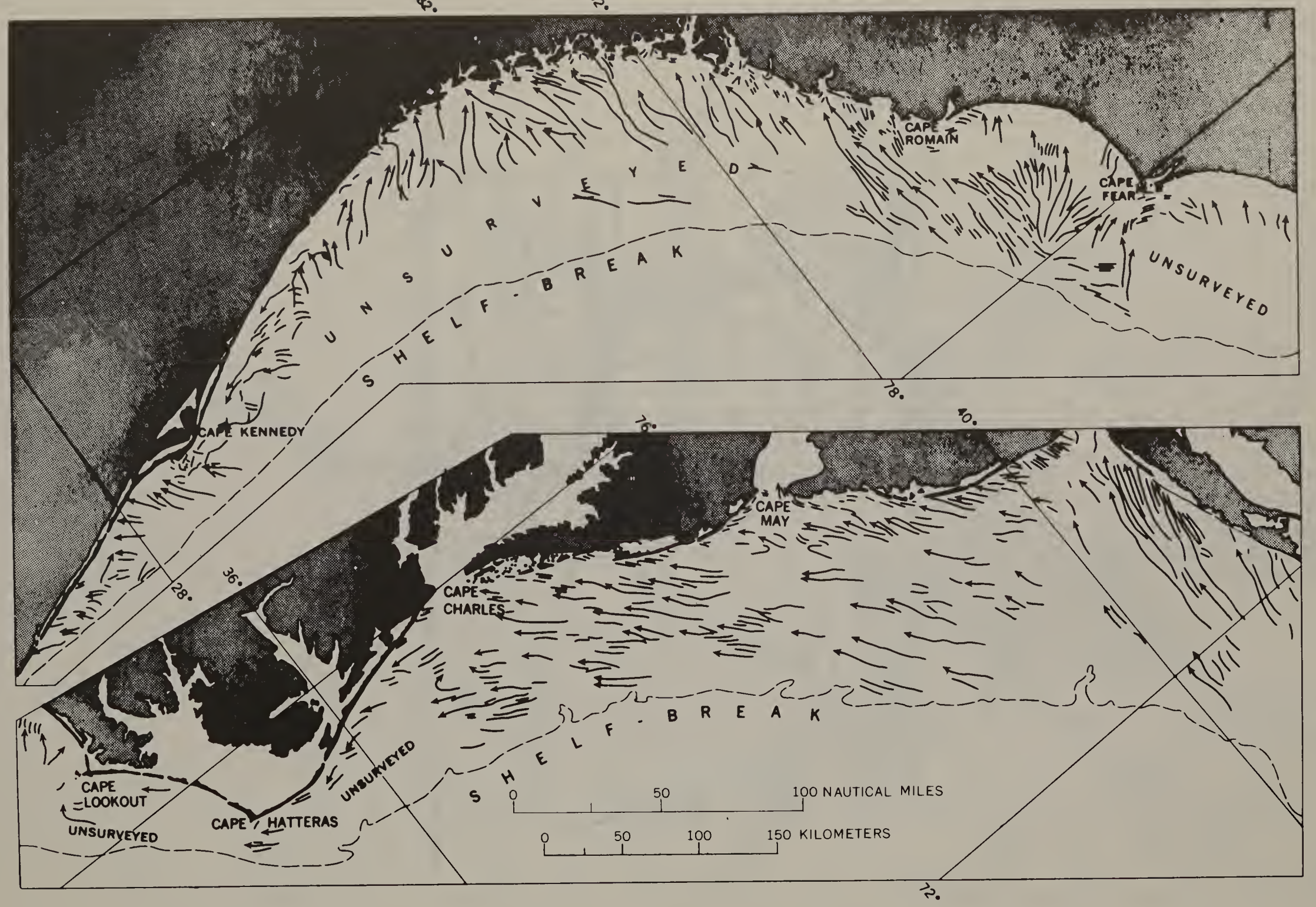
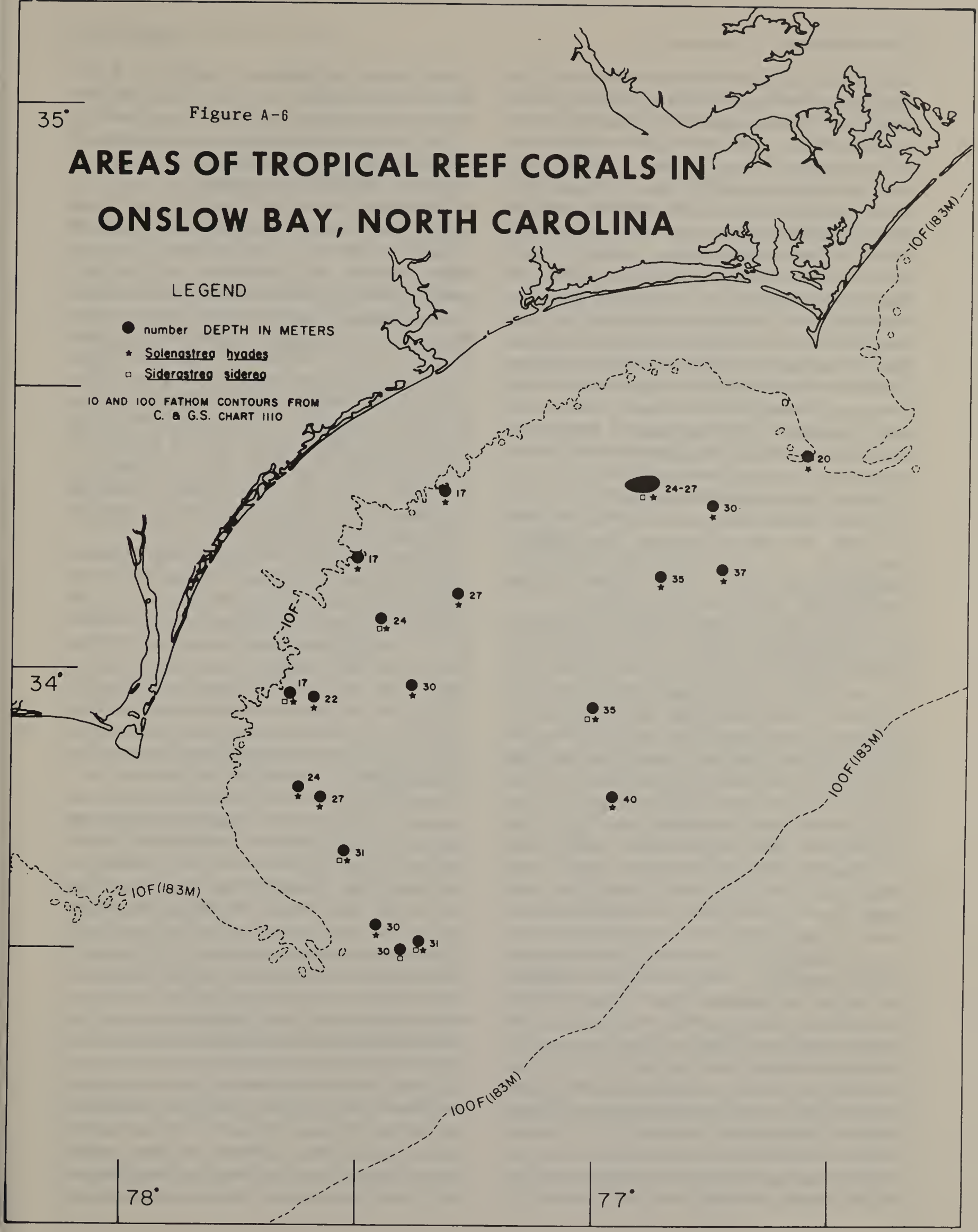


FIGURE A-5 Sand-swell crests on the continental shelf from New Jersey to southern Florida. Arrows placed on the inshore end of the sand-swell crests mapped by Uchupi (1969) resemble residual bottom drift directions determined by Bumpus (1965, 1969) and Norcross and Stanley (1967). This correlation suggests that the sand swells are alined parallel to the bottom current. The transport of bottom sediment may follow these drift directions. (HOLLISTER, 1973).

Figure A-6

AREAS OF TROPICAL REEF CORALS IN ONSLOW BAY, NORTH CAROLINA



ville Beach, Fla. to offshore Charleston, S.C. The best known portion of the inner banks is Gray's Reef (Lat. 31°24′, Long. 80°53′) about 32 km east of Sapelo Island. Hunt (1974), Henry (1975) and other researchers from Skidaway Institute, Ga., have studied the area with side-scan sonar, sub-bottom profiling, bottom towed cameras and diving. The inner banks appear to be low relief 'rocky' outcrops which support a growth of sessile biota, surrounded by loose sandy and silty material. These areas are commonly known as 'hard-banks' or 'live-bottom' areas and are areas used for sports and head-boat fishing. Growth on these banks appears sparse when the outcrops are covered with a thin layer of sediment and growth becomes concentrated on the rocky outcrop portion of the banks. The continuity of exposure of the outcrops or the relief (presumed to be approximately 3 to 5 m) is unknown at this time.

Less is known about the continuity of the middle banks than the inner or outer banks. The middle banks are shown to extend from offshore Jacksonville, Fla. to beyond the Frying Pan Shoals into the area of outer Onslow Bay and may be similar in nature to the inner banks.

A notable study for the Onslow Bay region is the Oceanographic Atlas of the Carolina Continental Marian (Newton et al., 1971). A study for the outer banks and the shelf break from Cape Hatteras to Fort Lauderdale was developed by MacIntyre and Milliman (1970). Major features that were surveyed include ridges in depths of 80 to 110 m near the shelf break off North Carolina (interpreted as Pleistocene algal reefs by Menzies et al., 1966). Terraces (Uchupi and Tagg, 1966) and ridges of algal origin (Uchupi, 1967; Uchupi and Emery, 1968; Zarudzki and Uchupi, 1968) which extend discontinuously along the shelf break from Cape Hatteras to southern Florida have been identified as relict features formed during low stands of sea level during the Pleistocene period (Fairbridge, 1960). Rona (1970) identified four ridges with sediment filled troughs off Cape Hatteras and interpreted these as algal ridges, or barrier beaches with algal coatings. Surveys are continuing on the shelf by MARMAP (Marine Resources Monitoring, Assessment and Prediction Project by the South Carolina Wildlife and Marine Resource Department) (Burrell, 1975). Various sources of published and unpublished data were reviewed and an outline of the major extent of the outer banks from offshore Cape Canaveral to Cape Hatteras is shown on Visual No. 2 N-S. Restricted outcrops of the outer banks probably exists southward along the Florida Escarpment.

The following information was presented by MacIntyre and Milliman (1970) for the shelf edge from Cape Fear to Cape Kennedy.

Topography: From Cape Fear (33°25′ N.) to an area just north of Cape Kennedy (29°15′ N.), the sea floor at the outer shelf and upper slope is mainly smooth and undulating, and the shelf break generally indistinct. Whenever there is no marked change in slope between depths of 60 to 80 m, the minor change in slope between depths of 40 to 50 m is taken to be the shelf break. Ledges, small terraces and slight rises are present near the shelf break in depths of 50 to 110 m, but no depth correlation was established between these features. The terraces occur at depths of 70 to 110 m, whereas the ledges (6 to 10 m relief) are in depths of 50 to 70 m. Rises commonly established on the edge of the ledges generally have relief of less than 5 m.

Bottom Photography: Bottom photographs from around the shelf break show mainly gravel and shell hash scattered in or partly covered by sand-mud matrix. Small rock fragments are present in a few photographs, and rough rock ledges covered by rich epifaunal growths are exposed locally; large clusters of the coral *Oculina* sp. are common off the coast of northern Florida. As in the area off North Carolina, the abundance of burrows, mounds and trails indicates considerable infaunal activity in this area of the sea floor.

Rock-Dredge Samples: Rock-dredge samples are generally similar to those taken between Cape Hatteras and Cape Fear; algal limestone, quartz-rich calcarenite, calcareous quartz sandstone and shell hash were collected from ledges and small rises at the shelf break. The noncarbonate fraction of the sandstones, however, is significantly higher than in the sandstones north of this area.

Sandstone and limestones nearly identical to those from the Cape Hatteras to Cape Fear region were received from small ledges or terraces, and small ridges associated with these features, near the characteristically indistinct shelf break in this area. The wide distribution of these rock types strengthens the hypothesis that they constitute a thin blanket of mainly Holocene sediments covering a pre-Holocene surface. Sparker profiles across the shelf edge just south of Cape Fear indicate thick sequences of steeply dipping prograd-

ing beds (Pilkey and MacIntyre, in prep). Although these data were obtained from only the northern part of this area, they suggest that the generally smooth and gently dipping sea floor of the outer shelf and upper slope is related to rapid deposition of pre-Holocene sediments, probably terrigenous sediments derived mainly from the Piedmont rivers of South Carolina and Georgia. The thick cover (49 m) of post-Miocene "shelly quartzose sand and sandstone" noted in a drill hole near the shelf break off Jacksonville, Fla. (JOIDES, 1965) further supports this suggestion.

3. Structure of the Southeast Georgia Embayment

The Southeast Georgia Embayment lies in a transitional zone between a predominantly classic depositional province north of Cape Hatteras and a carbonate province which includes Florida and the Bahamas. More than 400 wells have been drilled in Georgia and Florida (Visual No. 9), some drilling reached basement rock, and a few wells have been drilled in the Bahamas area. In the offshore area, in addition to taking short cores, a few test holes have been drilled several hundred feet during the JOIDES program into the Southeast Georgia Embayment (Figure A-7), but no well has been drilled offshore which penetrated pre-Tertiary strata. There are at least 2,800 m of sediments and possibly as much as 5,500 m of sedimentary rocks in the offshore basin beneath the Blake Plateau out to the 600 m water depth. It is likely that up to 4,000 m of Lower Cretaceous and Jurassic sedimentary rocks are present beneath the embayment.

The Blake Plateau has an average depth of 850 m. Uchupi (1967) describes the area north of latitude 32°s as relatively smooth, dipping seaward with a gradient greater than 0°30′ (9 m/km), and forming a transitional zone between the continental slope to the north and the broad and flat plateau proper to the south. The plateau is widest south of latitude 30°. This segment of the plateau is relatively smooth, except for a rough zone near the base of the Florida-Hatteras Slope. This irregular zone extends from the Straits of Florida to Cape Romain. Between latitudes 30° and 32° the jagged topography extends across the plateau. Within the area of rough topography there are large, broad and generally flat-bottomed hollows with reliefs in excess of 40 m. Around the margins of these lows and occasionally within them are innumerable conical hills that add to the relief of the depressions and accentuate the roughness of the topography. Bottom samples and bottom photographs indicate that the conical hills are coral mounds.

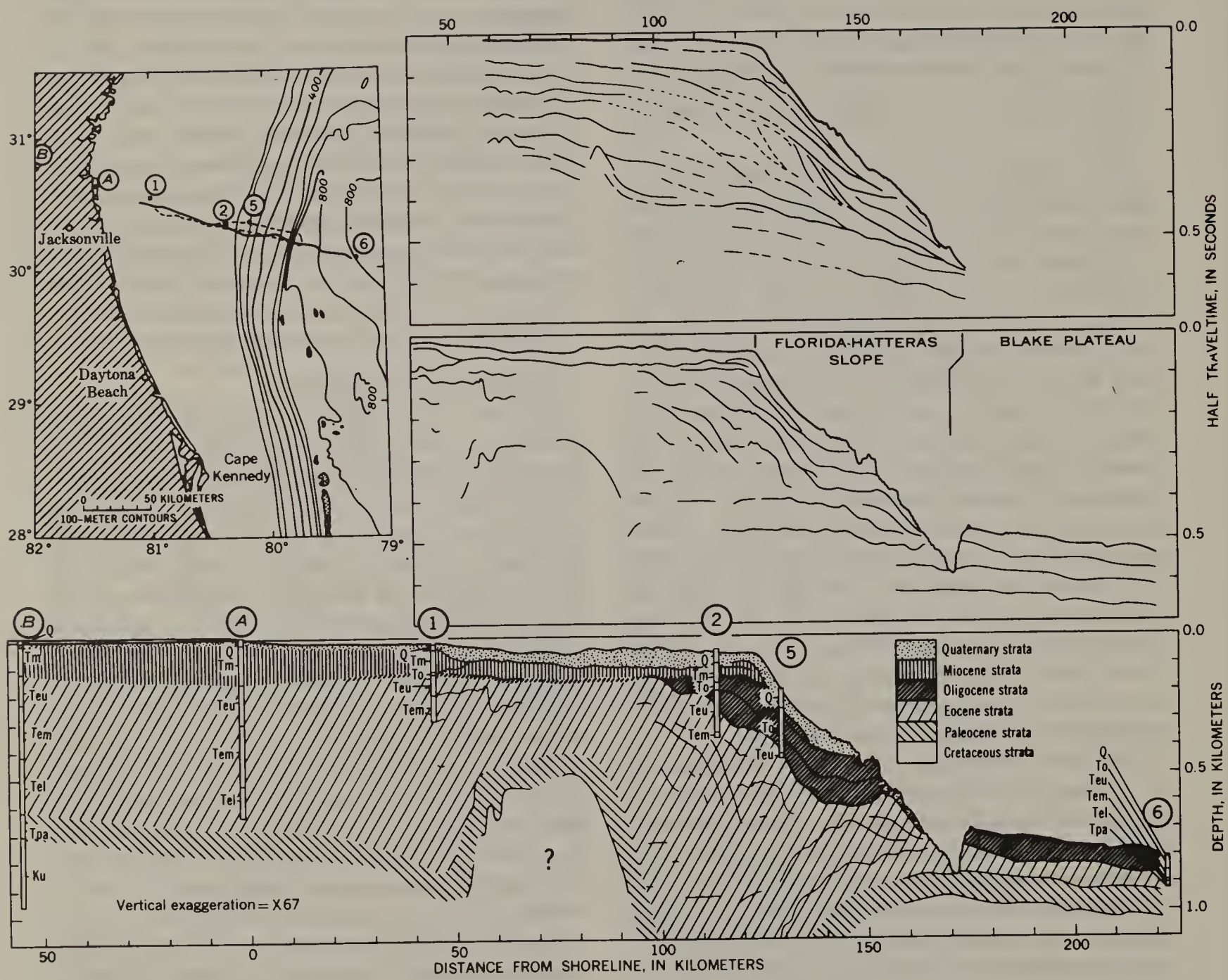
Pratt and Heezen (1964) have shown depressions in the floor of the western Blake Plateau that are thought to be erosional, possibly resulting from the deep currents associated with Gulf Stream flow. MacIntyre (1970) reported the existence of low relief mounds which were thought to be corraline in nature on the floor of the Blake Plateau. Studies involving the modern techniques of seismic reflection profiling (Markel et al., 1970) have covered the continental shelf and Blake Plateau with a series of tracklines (Figure A-8). Submersible work reported by Hawkins (1969) showed visual sightings of beds of manganese and phosphate concretions concentrated at the crests of sand waves on gentle slopes grading in size from nodules to solid pavement (Figure A-9).

4. Marine Surficial Sediments

Holister (1973) studied more than 800 bottom-sediment samples (Figure A-10 and Visual No. 9) which were collected from the continental margin between New Jersey and Florida and show that sand covers almost the entire continental shelf. The sand is mainly unimodal, is well sorted, and has a symmetrical grain-size distribution curve. Mean grain size generally increases toward the shelf break. Shelf sands containing an appreciable amount of calcium carbonate on the continental shelf south of Cape Hatteras are texturally similar to the sands consisting mainly of quartz and feldspar north of Cape Hatteras, and thus it appears that composition does not influence grain-size distribution. The continental slope off the Carolinas is covered by sand; north of this area, the slope is covered by clayey and sandy silt. The upper continental rise is veneered by silty clay.

Certain distinctive patterns of textural parameters appears to correlate with patterns of ocean-bottom circulation. The continental slope off Florida is covered by poorly sorted clay and silt deposited beneath the Gulf Stream Counter Current. Most fine-grained sediment is removed directly beneath the Gulf Stream. The silty sand near the southern margin of the Blake Plateau may be winnowed pelagic ooze transported from the eastern Blake Plateau by the westward-flowing Antilles Current. These two major current

FIGURE A-7 DRILLING ON THE CONTINENTAL MARGIN OFF FLORIDA, USGS PROFESSIONAL PAPER 581-A, BY K. O. EMERY AND E. F. ZARUDZKI, 1967.



Continuous seismic reflection profiles near JOIDES drill holes 1, 2, 5, and 6. The top right panel is a composite profile made by E. T. Bunce and S. T. Knott (in Joint Oceanographic Institutions' Deep Earth Sampling Program, 1965) just prior to drilling and along the route marked by a dashed line on the insert map. The middle panel is a profile made by Elazar Uchupi and A. R. Tagg (Uchupi and Emery, 1967) after the drilling and along the route marked by a solid line on the insert map. The bottom panel was constructed by adjusting the depths of the reflecting horizons in the middle panel for measured and estimated sound velocities (fig. 4) and correlating them with stratigraphic information from JOIDES drill holes and from wells on land (A, B) that were described by Herrick and Wait (1965) and Leve (1961).

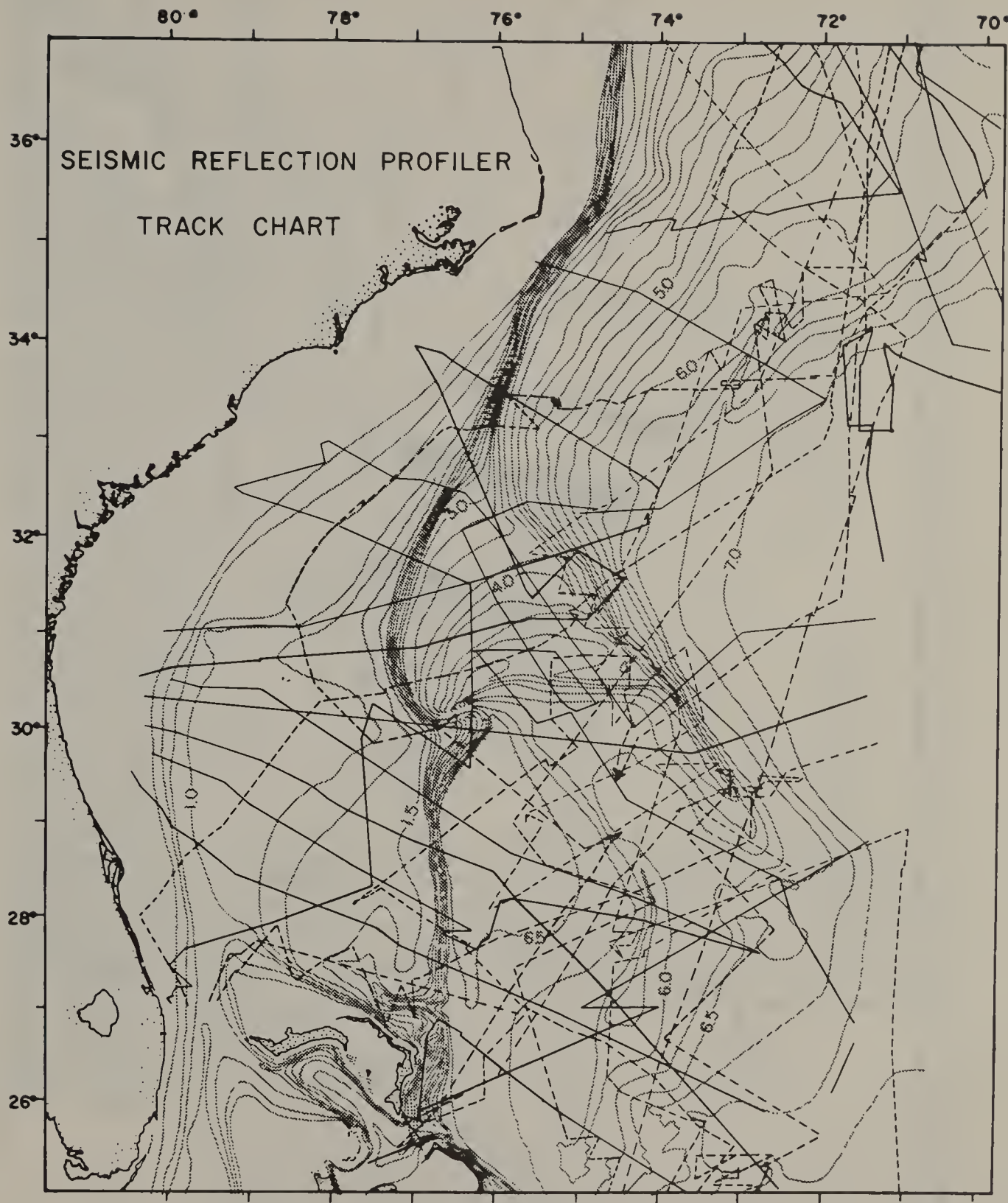


Fig.A-8 Bathymetric map and seismic profiler track chart of the area studied; contours are in seconds of reflection time (¼ sec = 100 nominal fathoms or 183 meters). Dashed tracks indicate the use of a pneumatic sound source; solid tracks indicate that explosives were used (MARKL ET AL., 1970)

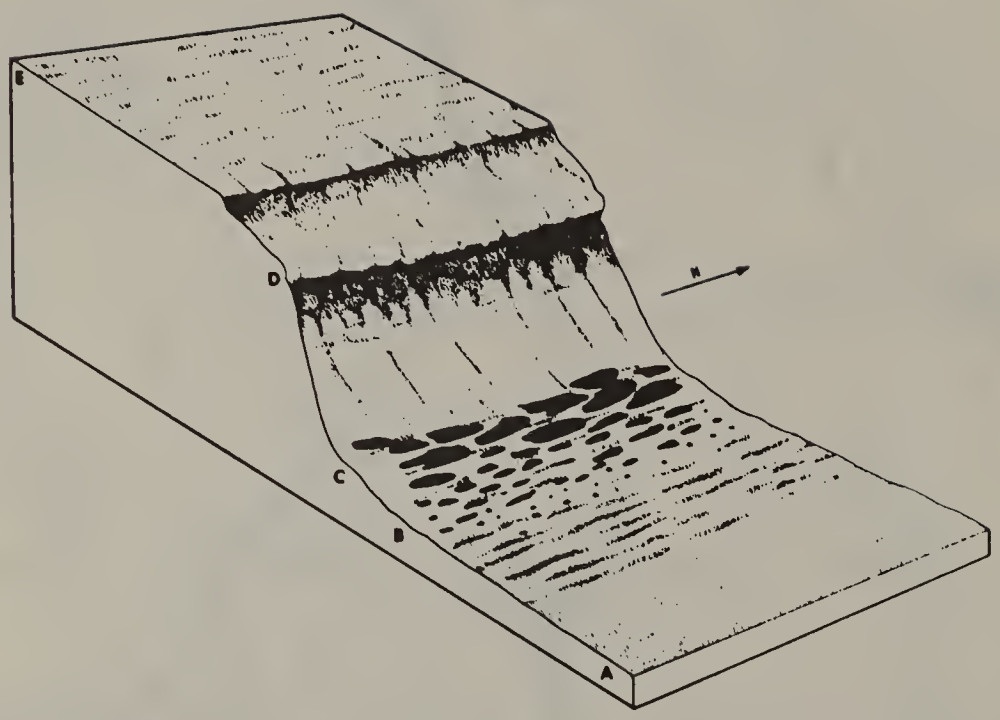
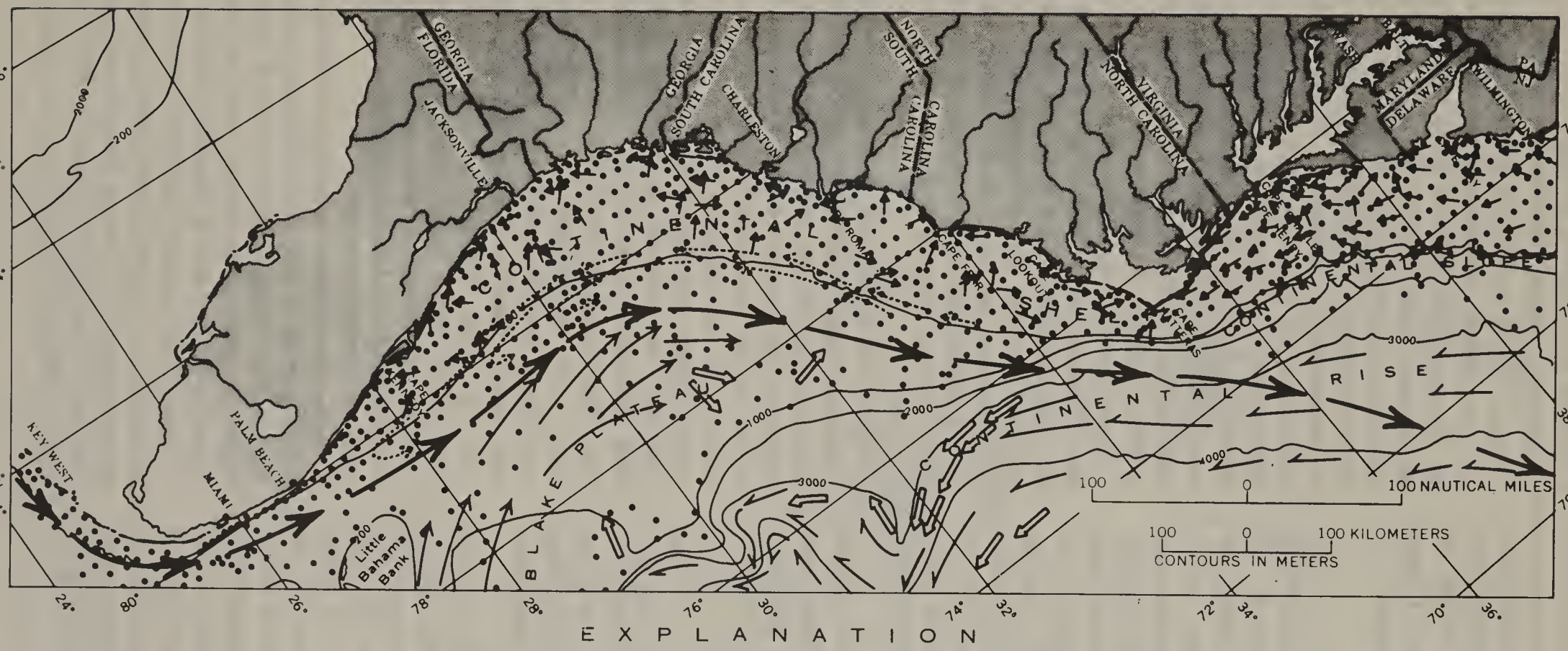


Fig.A-9 Diagrammatic view of area observed during dive 2. Vehicle bottomed at 1130 meters on a slightly undulating plain at A. A thin carbonate crust sparsely covers a manganese nodule and sand suite. Nodule exposures are intermittent with sand in N–S oriented windrows to B. From B to C the slope inclines 10° to 20°, and nodules grade to a larger size and finally to a fractured pavement at the base of the scarp. A talus slope of 45° terminates at the oxidized rock outcrop and overhang at D. From D to E a smaller talus slope and outcrop terminate the vertical feature, and the bottom resumes the appearance of nodules and interspersed sand. (HAWKINS, 1969)



EXPLANATION

Sample location

Gulf Stream
(Bottom axis)

Gulf Stream Counter Current

Antilles Current

Photographic current measurement
From Pratt (1963) and Heezen, Hollister, and Ruddiman (1966)

Western Boundary Undercurrent

Residual bottom drift
From Bumpus (1965) and Norcross and Stanley (1967)

FIGURE A-10

Continental margin from New Jersey to southern Florida showing sample localities and bottom currents. The area is south of the region of glaciation. Textures of surface samples taken north of the area shown in this figure are given by Schlee (1973). (HOLLISTER, 1973).

systems appear to control sediment texture on the Blake Plateau.

One of the most detailed offshore bottom sediment and shallow structure studies is being conducted under the direction of the U.S. Corps of Engineers, Coastal Engineering Research Center in Fort Belvoir, Virginia, by Edward P. Meisburger.

In 1964, a program was initiated to survey offshore regions of the Atlantic, Pacific, Gulf and Great Lakes coastal areas to delineate the character of sand deposits. Formerly called the Sand Inventory Program, it was initiated with a survey of the New Jersey Coast. Subsequent surveys have included the inner Continental Shelf off Florida, New England, New York, Maryland and part of North Carolina, Delaware, Virginia and California. The program is now referred to as the Inner Continental Shelf Sediment and Structure Program (ICONS). The ICONS program is directed towards mapping of sand deposits suitable for beach restoration and delineation of shelf structural characteristics.

As shown in Figure A-11, four surveys within the southeastern Georgia embayment have been studied and reports have been written. They are: TM No. 29, Long Key to Palm Beach; TM No. 34 Delray Beach to Cape Canaveral; TM No. 42 Melbourne to north of Titusville; TM No. 54 Cape Canaveral to St. Augustine. Data has been collected off the North Carolina Coast between Cape Lookout and the South Carolina border but no report has been written. Survey tract line grids have a one mile line spacing and reconnaissance lines were run in a zig-zag pattern.

Visual No. 9 bottom sediment portion is taken entirely from Newton, Pilkey and Blanton, (1971). This sediment distribution map is a textural classification with no particle size analysis. Fig. A-12 is a map showing the abundance of heavy minerals on the Onslow Bay portion of the Carolina Shelf. Heavy minerals represent a potential economic resource on the Continental Shelf. Figure A-13 is a map of the distribution of fine sand-sized phosphorite grains. The area of highest phosphorite concentration near Cape Fear has been examined by several phosphate mining companies as a potential deposit of commercial grade phosphate.

5. Coastal and Onshore Geology

A. GENERAL GEOLOGY AND PHYSIOGRAPHY

Capes, shoals and barrier islands which encompass the lagoons, marshes and coastal waterways, are the prominent features along this portion of the Atlantic Coast. Hoyt and Henry (1971) conclude that the concurrence of capes and rivers is too prevalent to be fortuitous. Cape Fear, N.C., is postulated to correspond to a shoal area seaward of the Pleistocene mouth of the Neuse River prior to its capture by the Pamlico River. Development of the Cape Hatteras complex has been augumented by sediments from the Roanoke and Pamlico Rivers and from the Susquehanna River-Chesapeake Bay system.

These capes are not deltas under present conditions; however, at the beginning of a glacial stage, the river gradients were markedly increased by sea-level lowering and deltas developed. As the sea retreated, the deltas formed farther seaward on the continental shelf, resulting in the deposition of deltaic ridges of sediment perpendicular to the coast.

During the subsequent submergence which accompanied glacial melting, the deltas became the loci of barrier islands and prominent capes. Submergence was accompanied by erosion and retreat of the barrier capes resulting in the present capes, shoals, and embayments (Figure A-14). Swift (1970) explains that the genesis of most barriers is that they have retreated in from the position of their immediate predecessors. Barrier genesis, in the classic sense of large-scale, refers to coastwise spit progradation or mainland-beach detachment depending on coastal relief and slope, with steep, rugged coasts favoring spit progradation at the expense of mainland-beach detachment. Since most major barrier systems form on flat coastal plains, it would appear that mainland-beach detachment is the more important mode of barrier formation.

During stillstands or periods of reduction in the rate of sea level rise, coasts can more nearly approach their climax configuration in which the shoreline is relatively straight, and the shoreface is well developed and of maximum possible slope.

Research on barrier islands and coastal terraces by Skidaway Institute particularly, explain the geomorphology of Coastal Georgia and Northern Florida. According to Oertell (1974), barrier islands along the Georgia coast are separated by

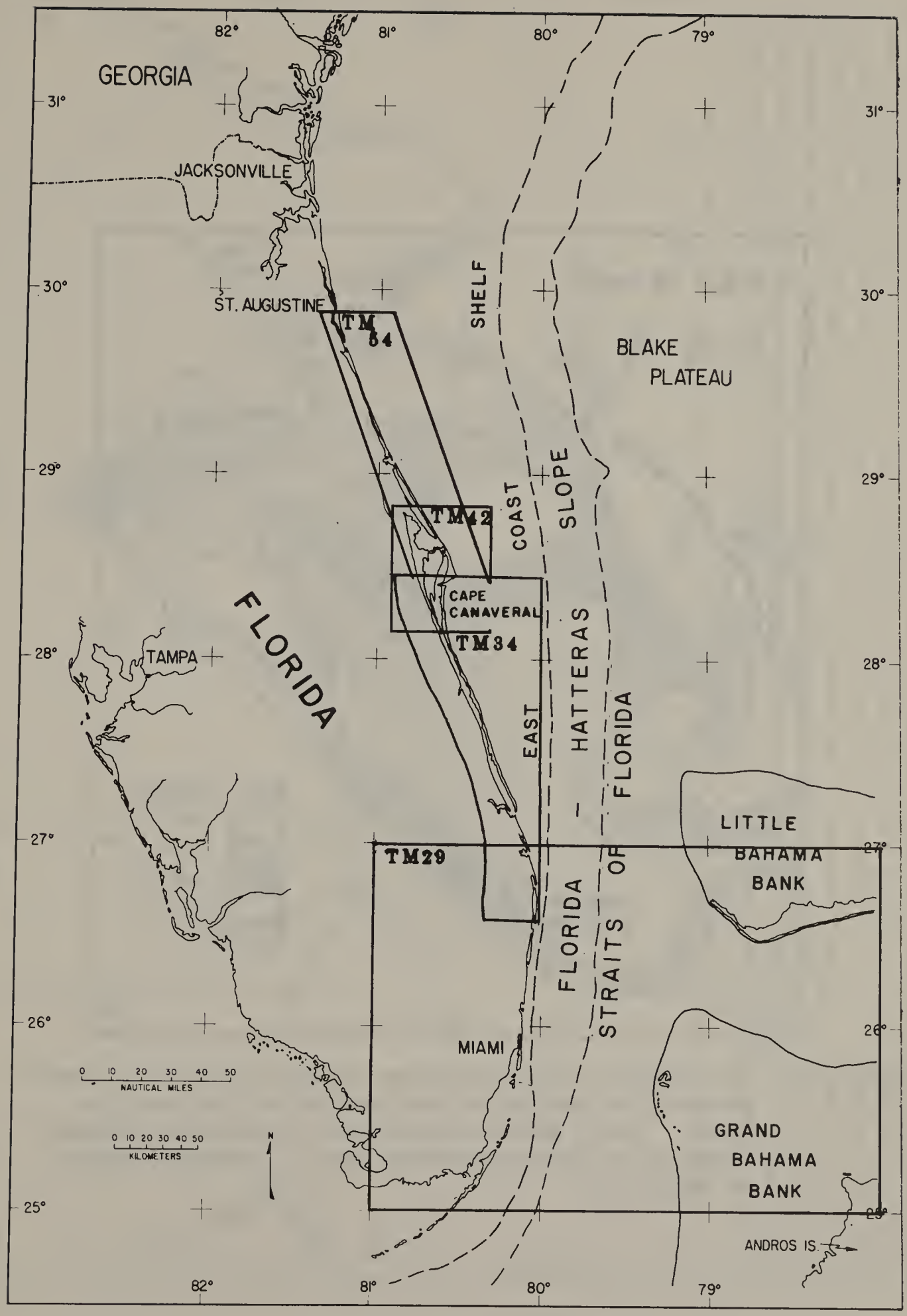


Figure A-11 **Map of the Major Physiographic Provinces of the Florida Continental Margin.** The survey areas are outlined. Source: U.S. Army Corp of Engineers, 1975.

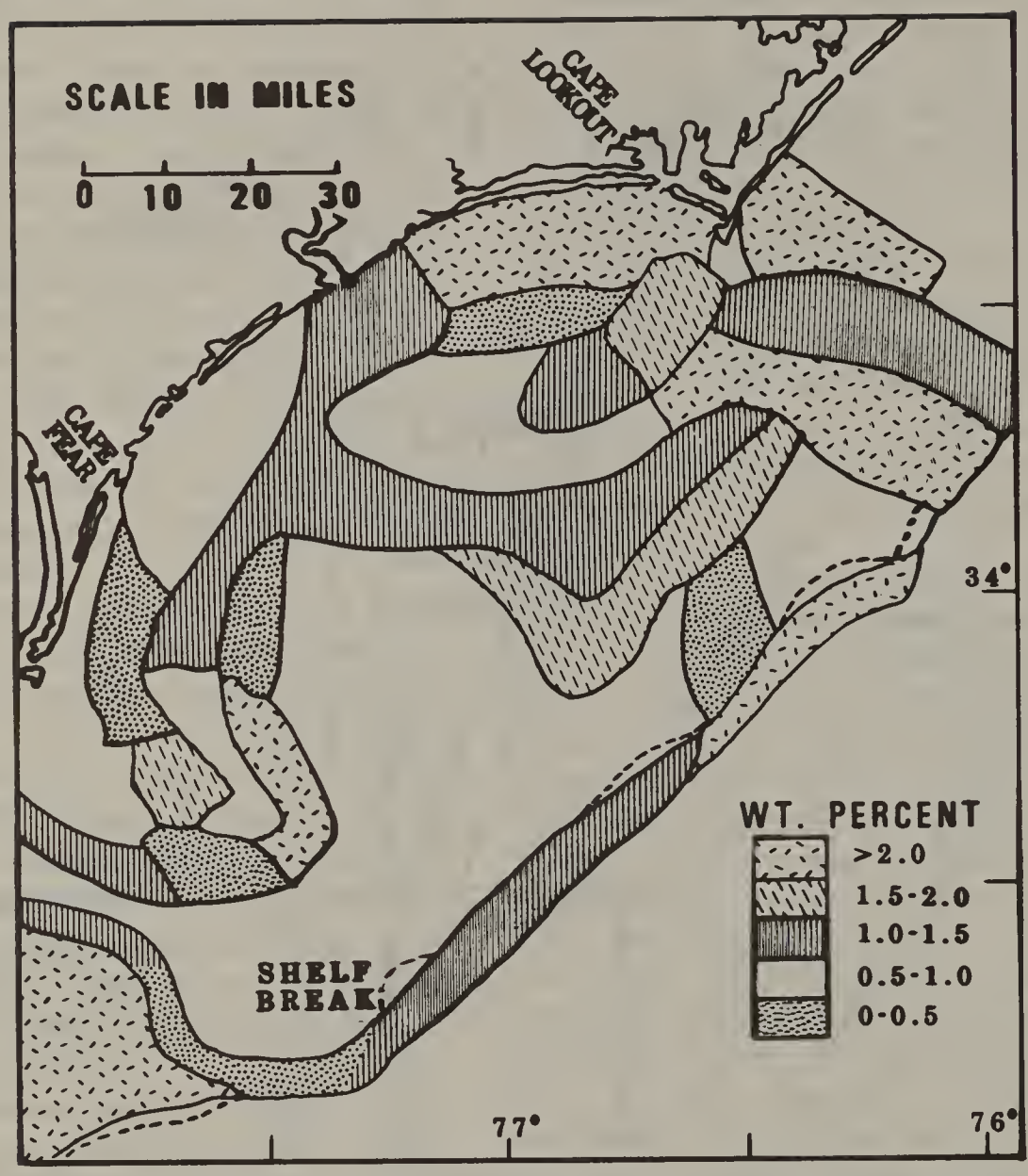


Figure A-12 Map showing the distribution of the abundance of heavy minerals on the Onslow Bay portion of the Carolina shelf. Heavy minerals represent a potential economic resource on the continental shelf. Source: Newton, et al., 1971.

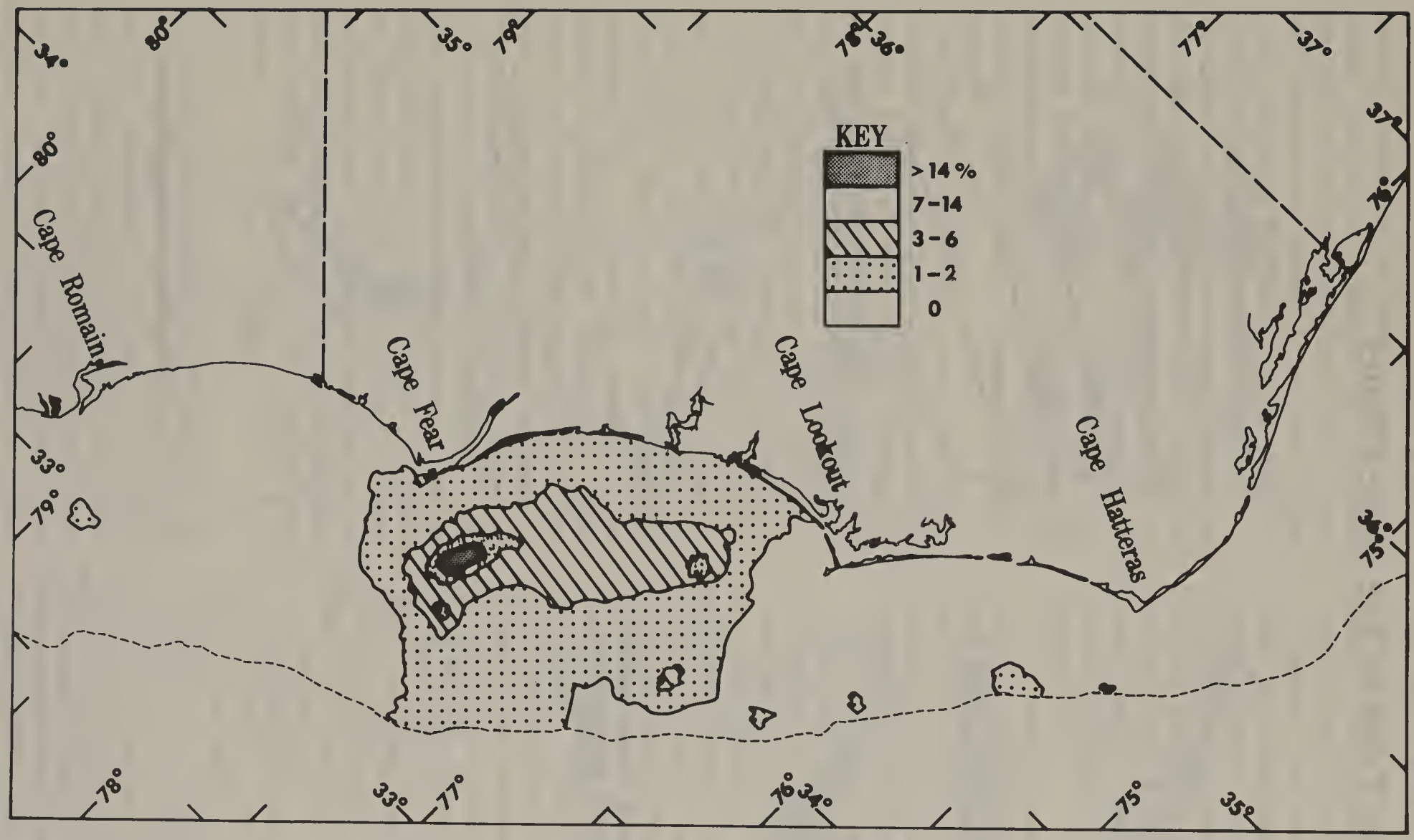
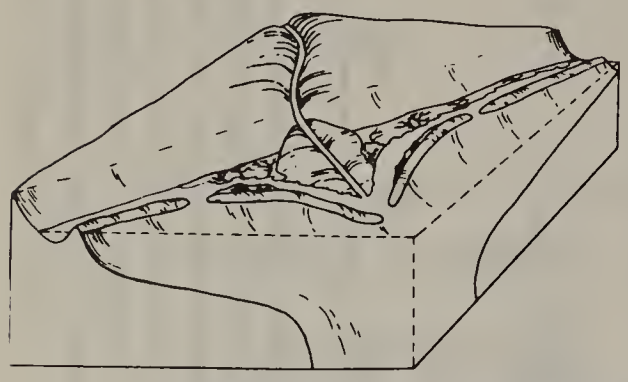
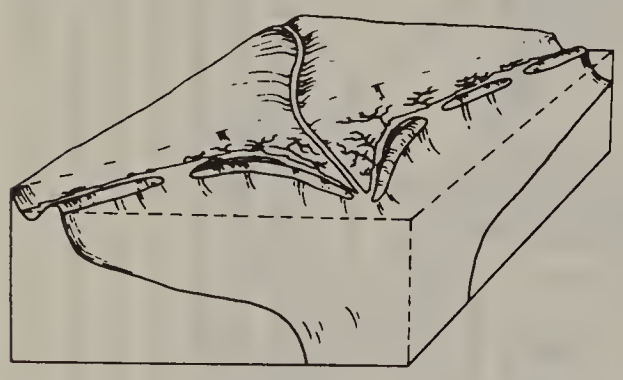


Figure A-13 Distribution of small sand-sized phosphorite grains recognizable by their shiny surface texture and black to dark brown color. The phosphorite distribution is one line of evidence indicating that sediment is being transported from the shelf to the shoreline. Present-day Carolina rivers carry only small amounts of phosphorite grains, but estuarine and beach sediments are often highly phosphatic. Close examination of the distribution reveals that when the adjacent continental shelf sediment contains phosphorite grains, beaches and estuarine sands are phosphatic. When shelf sands are devoid of phosphorite grains, nearby beaches and estuaries are not phosphatic. The area of highest phosphorite concentration near Cape Fear has been examined by several phosphate mining companies as a potential deposit of commercial grade phosphate. (From Luternauer and Pilkey, 1967).

Origin of Capes and Shoals along the Southeastern Coast of the United States



Idealized diagram showing formation of barrier islands along deltaic ridges by submergence of sand dunes.



Idealized diagram showing results of continued slow submergence and barrier islands retreat which resulted in present cape morphology.

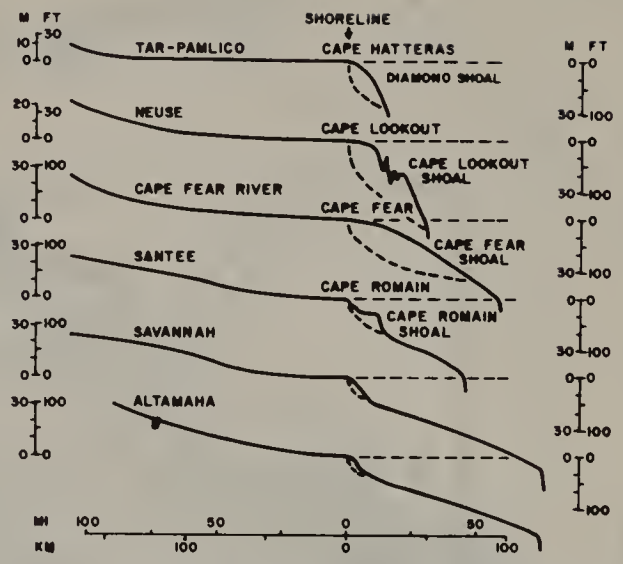
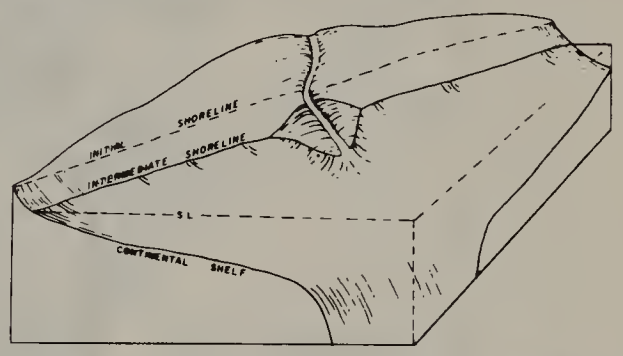


Diagram showing river and shelf profiles. Dashed profiles are from embayments adjacent to capes.



Idealized diagram showing deposition of sediment at river mouth as a result of lower sea level. Vertical scale greatly exaggerated.

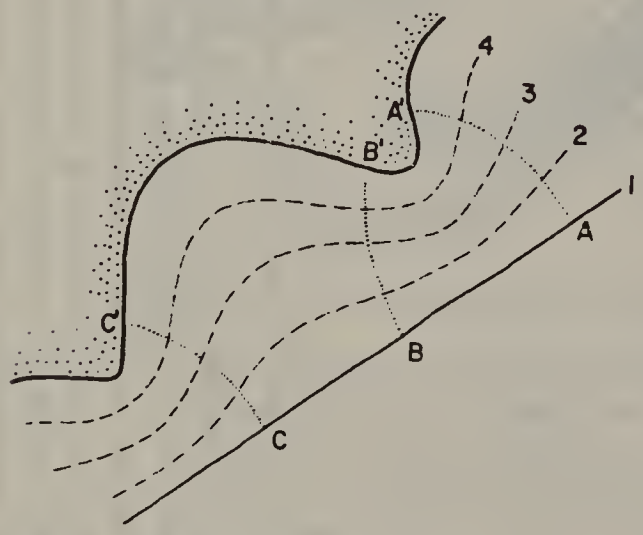
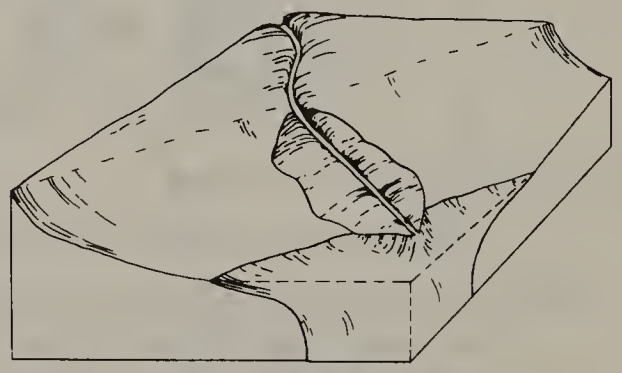


Diagram of wave refraction showing concentration of wave energy on headlands. Wave front A to B impinges on headlands from A′ to B′, whereas wave from B to C is spread along embayment from B′ to C′.



Idealized diagram showing deltaic ridge

Figure A-14 MAP SHOWING MORPHOLOGY OF CAROLINA CAPES AND SHOALS

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VERNON J. HENRY, JR.
Marine Institute and Department of Geology, University of Georgia, Sapelo Island, Georgia 31327

relatively deep inlet channels. These channels are generally deepest at the estuary entrance (inlet trough) and become shallower in a seaward direction—over a ramp to the sea, and in a landward direction—over a ramp to the sound (Figure A-15). Seaward of the inlet, the ramp to the sea is bordered by a peripheral-shoal complex.

On intertidal parts of ram-margin shoals, clean fine sands are deposited in a variety of low-amplitude bedforms. Mud and shell fragments are generally not abundant on these parts of the shoals. Heavy mineral concentrations are generally higher here than in the surrounding less turbulent areas. Flood-oriented bedforms may be present in certain areas on the seaward side of shoals.

The relict barrier islands also occur inland. Details of the coastal plan of Georgia are shown by Hails and Hoyt (1969) (Figure A-16) and are also shown on Visual No. 2S. Henry et al. (1973) relates that these geomorphic features extend inland about 60 miles from the Atlantic Ocean, on the eastern boundary of Georgia, and about 175 miles along the Florida state line. Sands and sandy loams make up most of their "terraces", except in the swamps, where the sands are covered by muck or peat. Seven eustatic shorelines—six Pleistocene and one Holocene—composed of segmented barrier islands, have been identified on the lower coastal plain. A cross section of these "terraces" is shown in Figure A-17.

Each barrier sequence can be related to the highest level of the sea during several Pleistocene glacial episodes, and can be further subdivided into barrier island and lagoon/salt marsh facies. The barrier island facies include dune, littoral and shallow neritic deposits, and the lagoon/salt marsh facies include salt marsh and tidal channel deposits.

B. SOILS

The soils areas illustrated in Visual Nos. 3N and 3S were prepared from general soil maps of the U.S. Department of Agriculture (Florida, 1962; Georgia, 1968; South Carolina, 1966; North Carolina, 1974). The U.S. Department of Agriculture (1938) provided a complete description of the soil types occurring in the southeastern states. Relatively shallow soil samples may have been utilized in developing theses maps. Caution should be used in utilizing these maps to determine stability for construction of large structures.

(1) Tidal swamp and marsh soils, and sand dunes: swamp and marsh soils occur in scattered areas in tidal channels at the mouths of rivers which empty into the ocean, in the quiet waters of lagoons, and behind barrier islands which fringe the coast. Generally the surface materials consist of brown, coarse, fibrous and matted peat. This surface peat material is porous and permeable, and gradually built up over black clay mud flats or gray loose sand by an accumulation of plant remains. Gradations from saltwater to brackish and fresh-water types are frequently encountered.

The shoreline consists of sand dunes and coastal beaches that border the Atlantic Ocean. The dunes, which are formed by wind, are mounded areas of dry, loose, very pale brown to yellow sand. Between the dunes are areas of nearly level fine sand, some of which are flooded twice daily by ocean tides.

(2) Atlantic Coast flatwood soils: consisting of unconsolidated sands, sandy clays and clays of recent geological origin. Practically all of the soils are characterized by matted subsoils which indicate poor aeration and drainage.

Most of the soils are light-colored and contain a small amount of organic matter, although there are large areas of black soils that are highly charged with organic matter.

(3) Poorly drained coastal soils: are similar in parent material and general characteristics to the Atlantic Coast flatwood soils except that they are located in poorly drained areas.

(4) Riverine alluvial and swamp soils: consist of recently deposited water laid materials which have been little changed by the environment. They normally consist of layers of sand, silt or clay with a fairly high organic content, especially in swampy areas.

(5) Southern Florida flatwood soils: ranges from sea level to 15 m in elevation. It is characterized by a dominantly flat to undulating surface, numerous low sand ridges and hummocks, water and grass ponds, swamp and tidal marshes. Natural surface drainage is poor except for the sand ridges. A hardpan layer in some areas prevents the free movement of rain water downward and the capillary rise of the water table water upward.

Surface layers range from light gray fine sands to brown heavy clays. Subsoils consist of heavy, fine sandy clay or heavy plastic clay, and, in hardpan areas, fine sand cemented by organic matter.

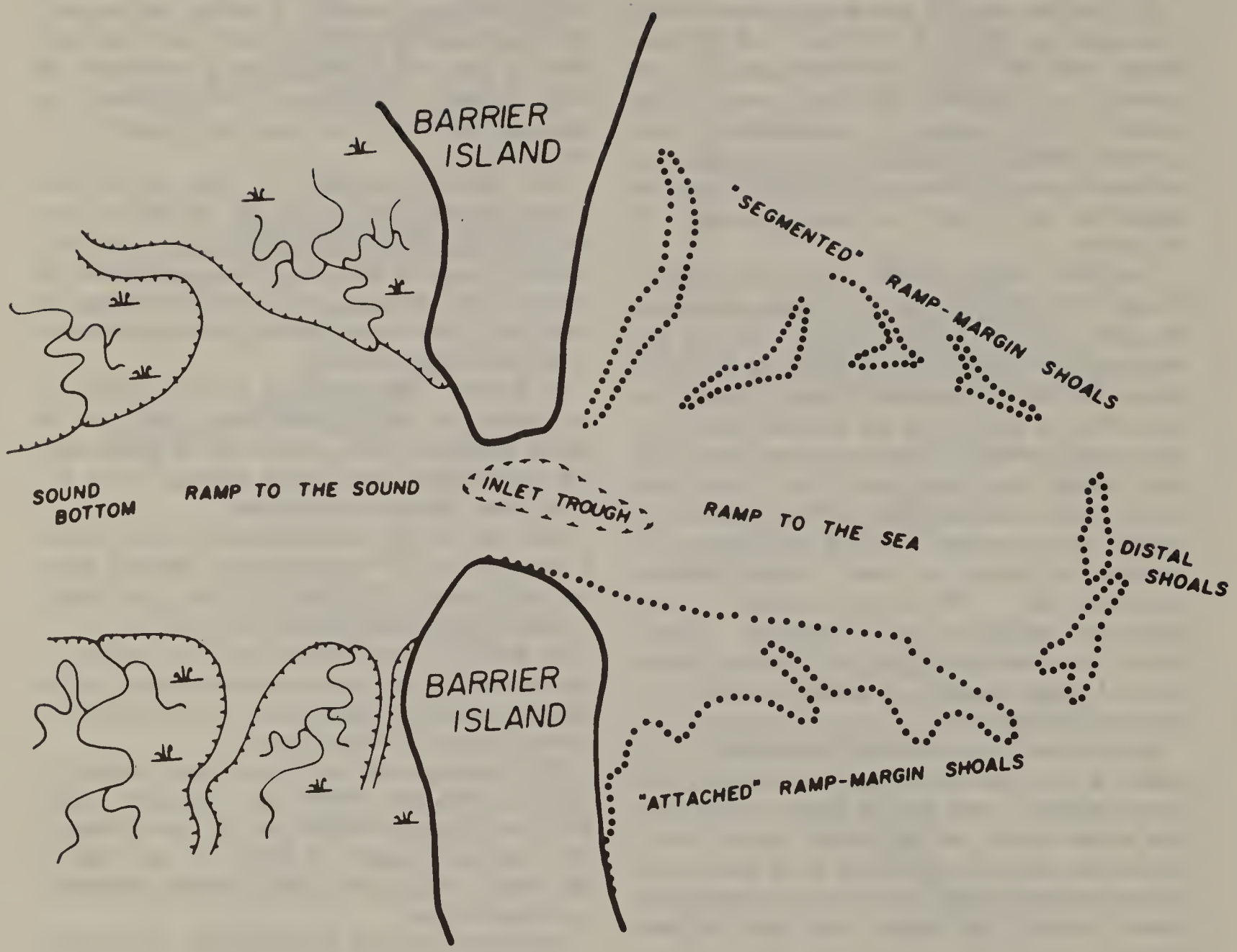


Fig. A-15 Generalized map of a Georgia tidal inlet, indicating the terminology of topographic forms (OERTELL, 1974).

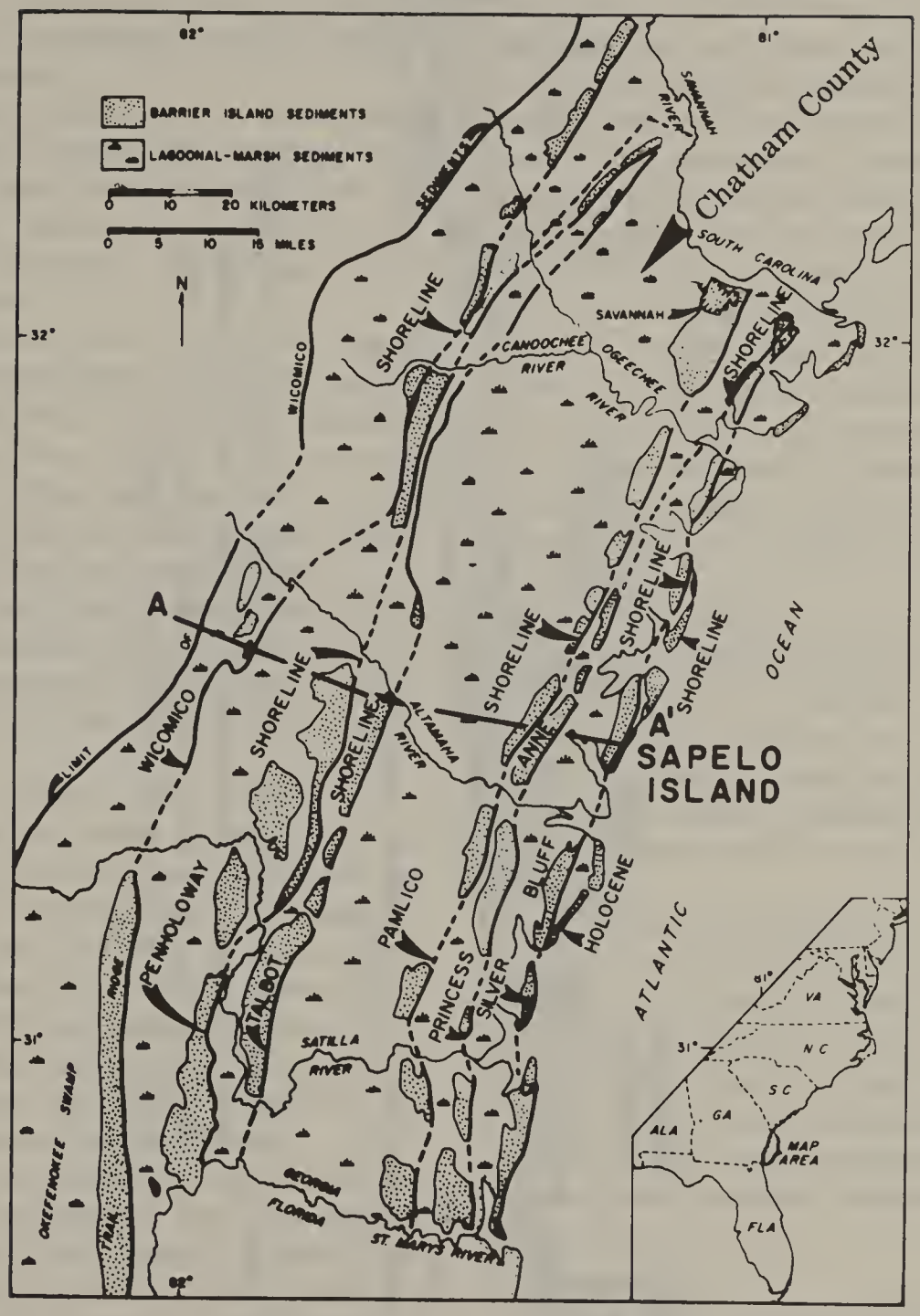


Fig. A-16 Lower Coastal Plain of Georgia, showing location of Chatham County and distribution of Quaternary barrier island/salt marsh sequences. Line A-A' = location of cross section shown in Figure A-17 (After Hails and Hoyt, 1969.)

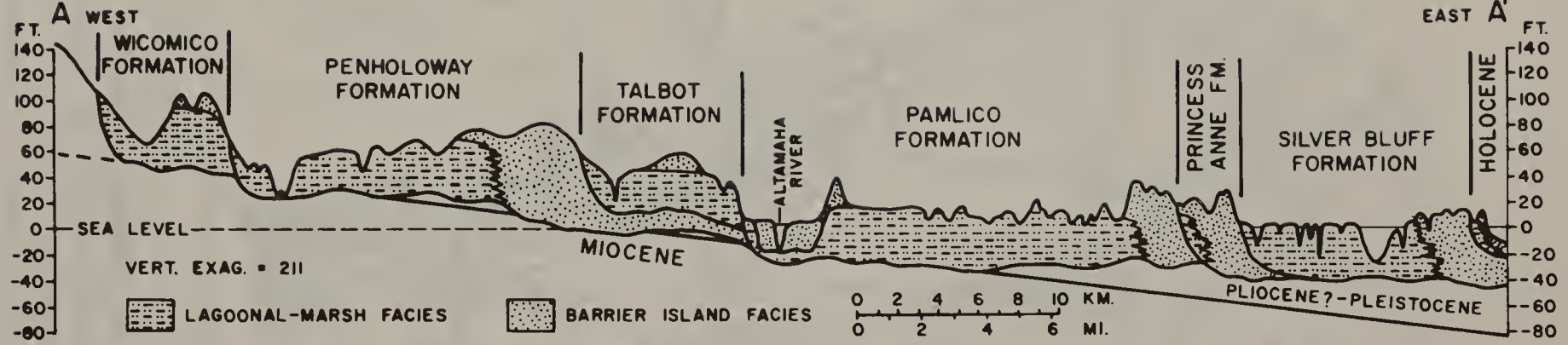


Fig. A-17 Diagrammatic cross section showing possible subsurface relationships of Quaternary deposits of the lower Coastal Plain. See Figure A-16 for location of cross section. (From Hails and Hoyt, 1969.)

(6) Everglades and associated area soils: consist of muck and peat. "Muck", is developed from black organic sediments originating from aquatic vegetation, occurs within a narrow belt bordering the southern shore of Lake Okeechobee. The soil contains some silt and clay, is dense when wet, and shrinks and becomes quite hard when dry. Practically all of it is underlain by brown fibrous peat resting on bedrock.

Brown or dark brown partly decomposed fibrous peat occupies most of the remaining area. It consists of fine roots and flattened coarse underground stems of dominantly sawgrass underlain by brown or dark brown fibrous sedge peat that rests on bedrock.

(7) Southern coastal plains soils: occupy a broad belt of land comprising the larger part of the Atlantic Coastal Plains above the flatwoods section, and ranges from 23 to 152 m above sea level. The surface of the land over much of this area ranges from nearly flat to undulating and is cut by many large rivers and small streams.

The soils are derived from unconsolidated beds of sands, sandy clays and clays. The soils tend to be light-colored, dominantly sandy in the surface portion, ranging from coarse sands to fine sandy loams.

(8) Freshwater marsh and swamp soils: developed from the vegetation of marshes, bogs and swamps. Each has contributed plant remains which have been accumulated either in basins of standing water or on land with a rising water level. Extensive areas of woody and fibrous peat and muck occur in the flat seaward portion of the southeastern Atlantic Coastal Plain. They occupy level upland terraces and border practically all lakes, ponds and streams near sea level.

The woody peat is generally dark brown in color, moderately decomposed and contains buried logs and stumps. Fibrous peat is derived from underground stems and roots of dense stands of cane, sedges, rushes and grasses accumulated in water basins.

(9) Sand hill soils: presents a rather conspicuous landscape, as the country rises higher than either the Piedmont or the typical Coastal Plain. Topography is quite variable, ranging from almost level to steeply sloping and hilly topography. Both surface and internal drainage ranges from good to excessive.

Parent material for these soils consist of beds of sand, probably old marine beaches, which are underlain by light-red, yellow, gray or white sandy clay material. Soils are mainly coarse sands with smaller areas of sandy loams and they are inherently low in mineral plant nutrients and organic matter.

(10) Southern piedmont soils: this soil area ranges from an elevation of 122 m bordering the coastal plains soils area, to much higher elevations westward. The topography varies from undulating or gently rolling to rolling, steep, and broken. The entire area is thoroughly dissected by streams and the natural surface drainage is good.

Parent materials for these soils are granites, gneisses and schists which underly most of the area. The soils are medium to strongly acid in reaction, low in organic matter, but contain much potash, particularly the subsoils. Scattered over the surface locally are fragments of quartz and occasionally outcrops of granite. Soils range in texture from coarse sandy loams to clays. Small scales of mica are common throughout the soil and subsoil.

(11) Central Florida ridge soils: this land area is dominantly undulating to gently rolling with some almost level areas and some that are hilly. Cypress swamps and thousands of lakes dot the region. Drainage is good to excessive over the area except in flatter depressions. There are few perennial streams and most of the drainage is subterranean.

Beds of marine-deposited fine sands overlying fine sandy clay are the parent materials for these soils. The soils have an extremely sandy texture, loose open consistency, very low content of mineral plant nutrients, a small amount of organic matter, and a strongly acid reaction. The dominant soil of the region consists of a light-gray or yellowish gray fine sand underlain by a fine loose yellow sand.

c. Hydrology

Improper well completion or trenching practices could cause contamination of artesian aquifers. Many municipalities along the coast depend on wells entirely, or in part, for their freshwater supplies, including Savannah and Brunswick, Ga. and Jacksonville, Daytona Beach, Cape Kennedy and Orlando, Fla. (Counts and Donsky, 1963; Klein, 1971).

The Floridan aquifer is artesian due both to the geometry of the dipping strata of the coastal plain and their varying permeability, Figure A-18. This

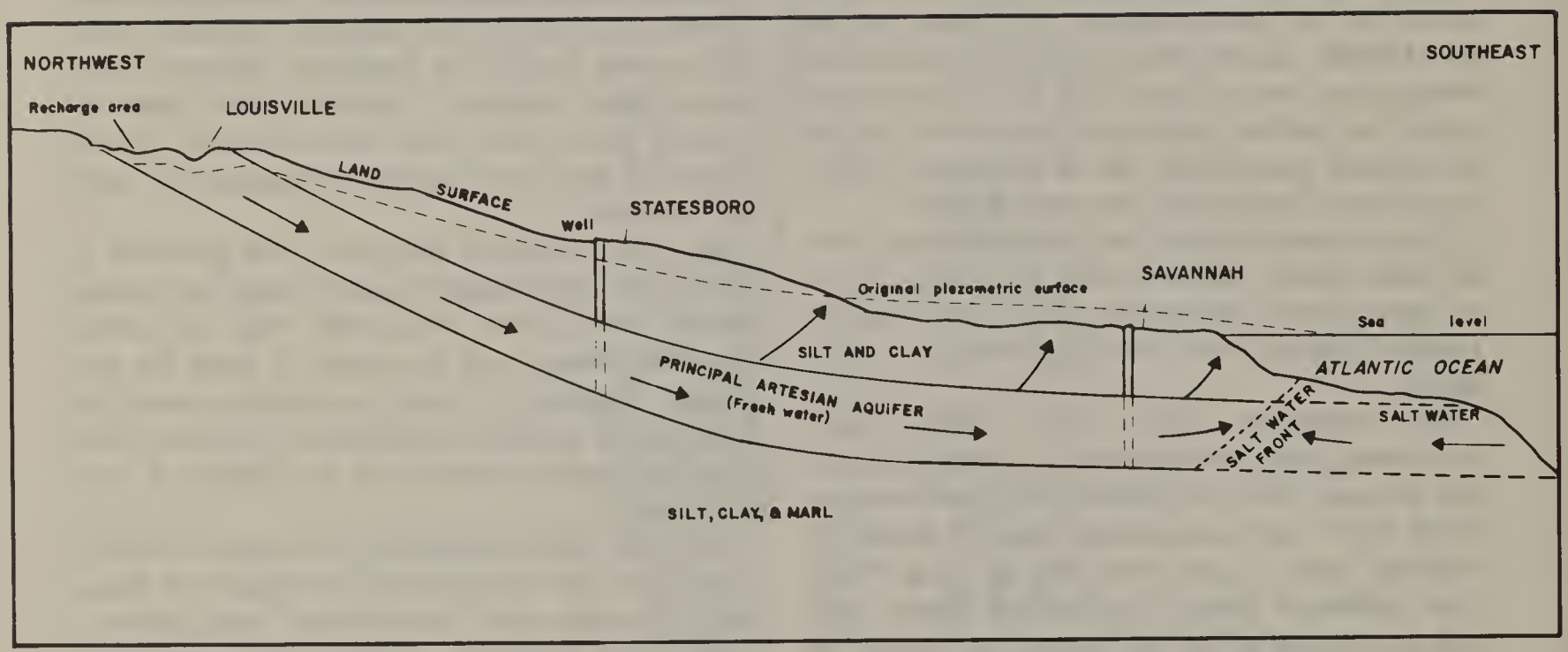


Figure A-18 Diagrammatic section of principal artesian aquifer, showing theoretical fresh water-salt water interface.

From Counts and Donsky (1963).

aquifer consists of Eocene, Oligocene and Miocene limestone which contain beds of dolomite, sand, silt, clay and marl (Callahan, 1964). Limestone of the Ocala Group (late Eocene age) occur as part of the aquifer in Florida, Georgia and South Carolina; the Eocene Castle Hayne limestone is apparently equivalent in North Carolina. Most of the water in the Savannah area is produced from Eocene and Oligocene limestones (Counts and Donsky, 1963). In Florida, the lower part of the aquifer consists of highly cavernous dolomitic limestone, ranging in age from early Eocene to Paleocene. The unit has been named the "Boulder Zone" because of its drilling characteristics, although no boulders exist. The Boulder Zone probably contains nonpotable water throughout the state (Klein, 1971). Potable water is generally produced from permeable zones in the limestone and from solution cavities in the upper part of the aquifer in Florida.

Principal artesian aquifers extend offshore beneath the continental shelf. Freshwater from these aquifers flowed from the drill pipe at JOIDES hole J-1 (Visual No. 9) on the inner shelf 40 km off Jacksonville, and slightly saline water was obtained at hole J-2 on the outer shelf 120 km from the coast (Manheim, 1967). Brackish water was obtained from the deepest sample of hole J-5 on the Florida-Hatteras slope from upper Eocene deposits. In the Savannah area, the present fresh water-salt water contact in the aquifer is thought to be farther seaward than would be predicted from a static balance based on position of sea-level and the head of water in the aquifer (Counts and Donsky, 1963). This is considered to be due to a flushing of salt water from the aquifer during Pleistocene sea-level lowering and a lag in landward movement of the salt-fresh interface after sea-level rise. Freshwater apparently persists in the offshore part of the aquifer as far as Cape Lookout, N.C., where it is believed to extend a few miles offshore, whereas north of Cape Lookout all offshore beds contain salty water. Offshore springs also provide evidence for offshore extension of the aquifer (Callahan, 1964; Stringfield, 1966; Manheim, 1967). Submarine springs are formed by breaches in the confining bed of the aquifer, and represent locations where ocean water can enter the aquifer if head is not maintained. Such saltwater intrusion apparently is happening in the Savannah area (Counts and Donsky, 1963). The deeper parts of the principal artesian (Floridan) aquifer beneath much of the Florida platform are considered to be open to slow circulation of ocean water driven by geothermal heating (Kohout, 1965). This probably has caused accelerated solution of rocks to form caves and sinkholes.

In the Brunswick, Georgia area native ground water in the principal artesian aquifer is of the calcium bicarbonate type, very hard, alkaline, and low in chloride. In a roughly triangular area of downtown Brunswick, brackish water in the zone confined by dolomites is rising through a locally porous part of the upper dolomite and is spreading northward in both permeable zones of the principal artesian aquifer at rates up to 213 m/yr.

Any increase in pumpage which would enlarge present cones of depression would accelerate this rate. Elsewhere, the quality of water in wells that had been contaminated has returned to that of "native" water after the parts of the wells which penetrate the chloride-bearing zone had been plugged. None of the high-chloride water comes from lateral sea-water encroachment, nor is any likely to do so in the future (Wait & Gregg, 1973).

The USGS and South Carolina Water Resources Division are jointly conducting a groundwater study in all coastal counties of South Carolina. Monitoring of wells will enable them to map groundwater movement, alterations of groundwater character, piezometric head and movement of the fresh-saltwater interface.

6. Potential Geologic Hazards

A. SEISMIC

Although minor earthquakes and microseisms occur yearly in South Carolina (Bollinger, 1972) (Figure A-19), only one earthquake is known to have occurred offshore. In 1960, an earthquake occurred near Charleston at 33° N. latitude and 80° W. longitude (Figure A-20) and was a magnitude of V (Coffman and von Hake, 1973). The only earthquake in this region large enough to have been a serious hazard was the Charleston earthquake of 1886. The magnitude of this quake was IX-X (Modified Mercalli Scale of 1931) and affected an area of over 1,287 km in radius. Earth waves were estimated to be over 0.6 m in height. The quake was followed by 10 severe aftershocks and numerous light aftershocks. More than 400 quakes have occurred in Charleston area since 1754 (Bollinger, 1972).

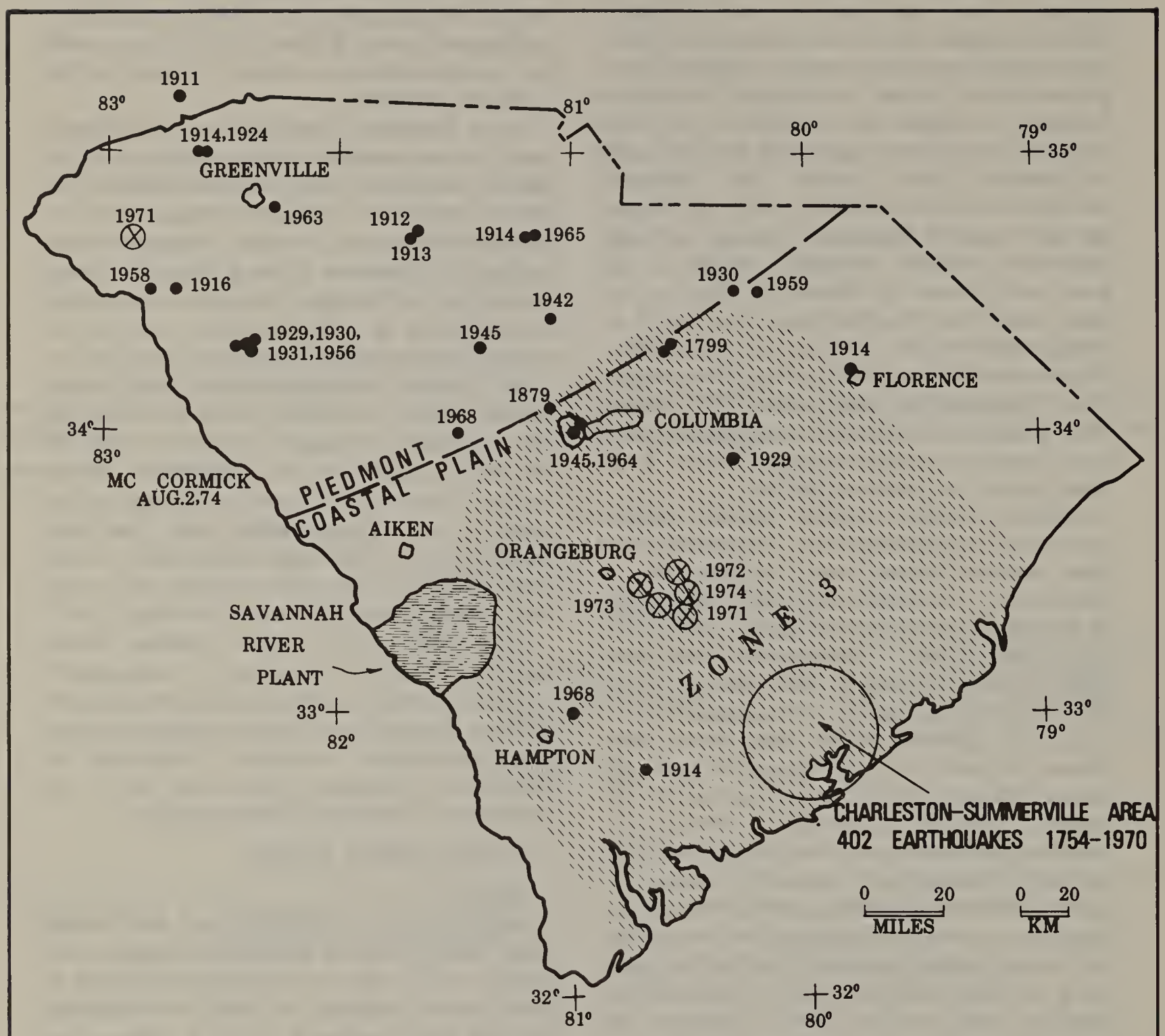


Figure A-19 Seismicity map for South Carolina. Year is given by each epicenter (from Bollinger). Map is updated to include 1972 and 1973 earthquakes. Map also includes seismic risk zone 3 (Algermissen, 1969), and the McCormick earthquake.

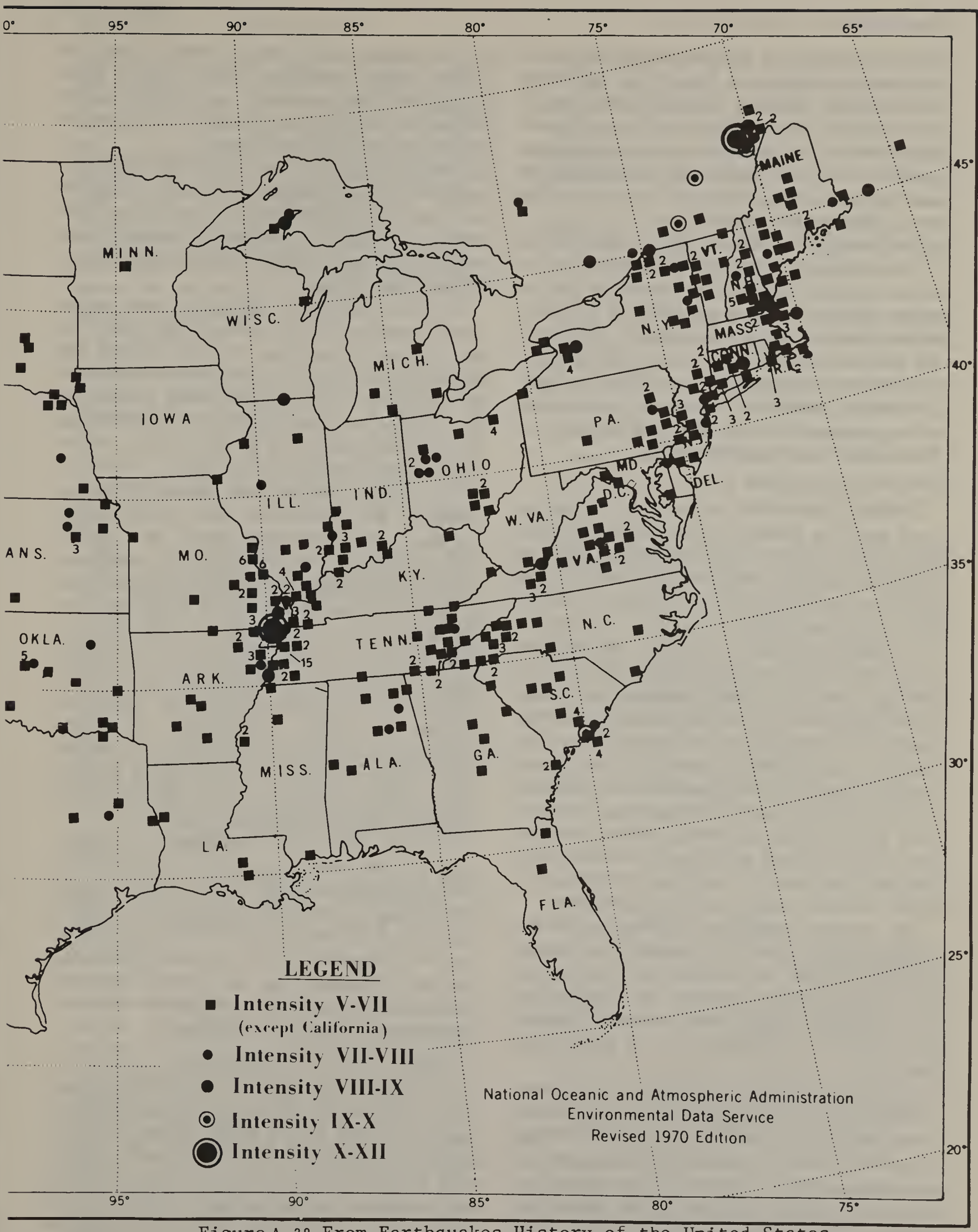


Figure A-20 From Earthquakes History of the United States, Coffman and Von Hake, 1970.

Present projects to monitor earthquakes in the area being undertaken by Arthur Tarr and others of USGS and Paradeep Talwani, University of South Carolina under ERDA contracts. Stewart (1975) stated that indications of pre-earthquake conditions occur at Cape Fear near Wilmington and Southport, N.C., about 113 km north of the area of high nominations interest.

The Charleston quake of 1886 occurred about 113 km west of the area of high nominations interest, and the causes of the quake are still an enigma. The incidence or probability of a damaging earthquake is rather low, however, the risk is still high and the Charleston area is rated as Zone 3 (Algermissen, 1969 and Perkins, 1974). In Zone 3 a major destructive earthquake may occur which corresponds to intensity VIII or higher on the Modified Mercalli Scale of 1931.

B. BOTTOM CONDITIONS

Platforms constructed on the outer continental shelf could be damaged by movement of their supporting material. This movement can occur by sediment transport either by scour or by mass movement and by collapse of sea floor rocks related to solution cavities.

(1) Sediment transport by scour: As noted in the section on marine surficial sediments (II.A.4.), the mid and outer shelf sediments are sands which appear to be in textural equilibrium on this shallow shelf. The presence of primary structures such as cross bedding, ripple marks, and graded bedding indicate active deposition or redeposition. In the high energy zones near the capes, mud and sand are carried seaward by current and wave action across the shelf and deposited on the slope. Between the capes, a shoreward migration of grains from the central and outer shelf occurs.

The dynamic sedimentary environment of this shallow shelf indicates the possibility that bottom structures would be affected by scour around their supports. This would also be a problem on the inner Blake Plateau where erosional features are common and produced by the Gulf Stream flow.

(2) Mass movement of sediments: The medium to coarse sand which predominates on the shelf would be relatively dense as a result of reworking by ocean currents and thus should offer good support characteristics. However, dense sands typically provide great resistance to pile penetration. Patches of lagoonal muds and peats which occur on the shelf would result in scattered areas in which support capabilities could be very poor, since static bearing capacity and stability against sliding can be drastically reduced by the presence of even a very thin layer of clay.

Slumping occurs on the slope where fine sediments are being deposited. Clays being deposited here are semi-consolidated at best. Slope sediments have had no subaerial exposure and, lacking desiccation, retain their mobile plasticity (Dillon et al., 1975).

(3) Karst topography: Submerged karst topography (irregular surfaces and caverns created by the solution of limestone rock by surface and ground waters) extends offshore from Florida and the Bahamas. The Ocala Limestone (Eocene) is one of the principal aquifers of southeastern Georgia and Florida and is known to be cavernous throughout most of this area.

The cavernous porosity encountered during the drilling of the Bahamas Oil No. 1 Andros Island has been well documented (Maher, 1971: Meyerhoff and Hatten, 1974). Caverns were penetrated at 15 different depths and at the total depth 4,448 m; 2,430 m of drill pipe was lost in the hole (see Visual No. 9 for well location). Circulation of drilling mud was lost at nearly all cavernous zones listed above, indicating that they extended laterally for considerable distances. Cavernous porosity was also encountered in Lower Cretaceous carbonates in the Esso No. 1 Hatteras Light between depths of 2,550-2,575 m (Maher, 1971). Such porosity may exist throughout the southeast Georgia Embayment area.

In areas where Karst topography is present, loading of the shelf surface above a cavern by a bottom mounted platform could result in collapse with damage to structures and possible leakage of water or oil. Modern geophysical hazards surveys can be designed to detect cavernous limestones and Karst features near the surface; however, deep caves causing loss of circulation are nearly impossible to detect prior to drilling.

C. OTHER NEAR SURFACE HAZARDS

Trenching or burying of pipelines which is common in the Gulf of Mexico can protect pipelines from many near surface hazard forces; however, trenching or jetting of pipes in the South Atlantic OCS will be difficult due to the hardbank outcrop and compacted surface sediments which exist in many areas. Trenching into the zones of ground-

water aquifers can release artesian flow and cause loss of head and subsequent salt water intrusion. Trenching of pipes may offer a poor solution to the hazard problem in many parts of the Atlantic OCS, and sandbagging or bridging of pipes across outcrops may also be an unmanageable. Serious study of this problem will be necessary before a workable solution can be presented.

Hazards such as creep, slumping, gasification, subsidence and near surface faulting are of a lower order of concern in this area in comparison to the Gulf of Mexico.

D. GEOPRESSURES

It is speculative at this time to state that hazardous geopressures can be anticipated in the Southeast Georgia Embayment or Cape Fear Arch. Proper mudweight will compensate for geopressure and as in the case of aquifer protection much of the responsibility is left to the experienced and alert procedures used by the drillers.

Many wells penetrating Mesozoic rocks in the State of Mississippi have encountered geopressures well above the 0.65 psi/ft. gradient which is considered the lower limit of the over-pressured section in the Tertiary strata of the Gulf coast. Wells in up-dip locations encountered hydrostatic geopressures while those in down-dip or seaward locations encountered geopressures. Whether these geopressures extend to offshore Georgia and South Carolina is not known at this time, but the Jay field (in the Florida panhandle) which produces from the Jurassic Smackover (Figure A-21) formation, does not encounter these geopressures (Visual No. 9).

In addition to geopressures, hydrogen sulfide (H_2S), which does extend into Alabama and Florida, is hazardous to those people which work on the rig.

E. SUBSIDENCE

Davis and others (1963) reported land subsidence of as much as 200 mm at Savannah, Georgia, due to decline of artesian pressure in a limestone aquifer. Precise leveling in 1918, 1933, and 1955 by the U.S. Coast and Geodetic Survey indicated maximum subsidence of bench marks of about 100 mm. Most of the subsidence occurred during the period 1933-1955. Pumpage increased from 23 million gallons per day in 1933 to 57 million gallons per day in 1955, and decline of artesian head was about 40 feet in the 37 years before 1933 and about 100 feet in the 22 years after 1933. A close correlation was noted between subsidence, pumpage, and decline of artesian head.

During the period 1933-1955, subsidence exceeding 20 mm occurred in an area of 50 square miles including the city of Savannah and extending 5 miles to the north and west. As shown on Figure A-20.1, the subsidence corresponded closely in areal extent to the area of greatest decline of artesian pressure during the same period.

The ratio of subsidence to decline of artesian pressure at Savannah of 0.0033 suggests that the maximum subsidence may have been about 200 mm from 1918 to 1955 in the area of greatest decline of pressure. The maximum rate of subsidence may have been about 200 mm from 1918 to 1955 in the area of greatest decline of pressure. The maximum rate of subsidence recorded by a bench mark was 40 mm during the 10-year period 1945-1955 at a point about 2 miles south of downtown Savannah.

Unlike the sediments of many other subsiding areas, the principal artesian aquifer at Savannah, in which the pressure has declined, is a limestone sequence. The aquifer ranges in age from middle Eocene to Miocene and includes the Gosport Sand (middle Eocene), the Ocala Limestone (late Eocene), undifferentiated limestone of Oligocene age, and the Tampa Limestone (early Miocene). The Ocala Limestone makes up substantially more than half of the sequence. The principal aquifer is confined below by marl and limestone of the Lisbon Formation (middle Eocene) and above by silty deposits of the Hawthorn Formation (Miocene); it consists chiefly of soft, granular, commonly highly porous limestone but includes also beds of sand, marl, and sandy, clayey, cherty, and dolomitic limestone.

Davis and others (1963) concluded that the subsidence is due to compaction of the principal artesian aquifer in response to decline in artesian pressure and that the compaction probably occurs chiefly in the soft limestone and in the interbedded clay and marl, which may be highly compressible. The ratio of subsidence to decline in head has been about 1 to 300, that is, about 100 mm subsidence to 100 feet of head decline.

F. GEOLOGICAL HAZARDS SUMMARY

It is difficult to rate hazards in an offshore area which has no previous drilling history. We can however, compare this area to what is already

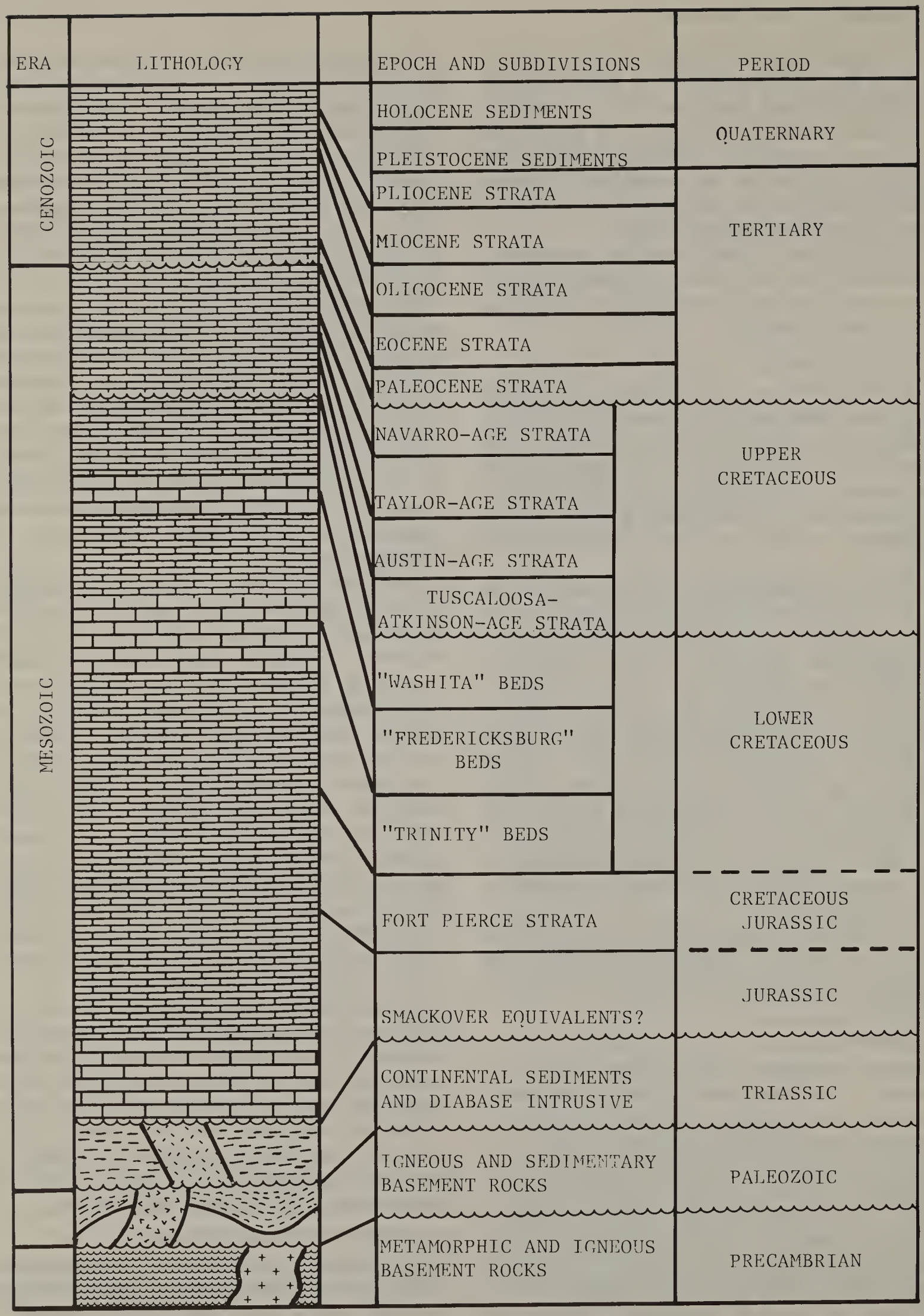


FIGURE A-21 SUMMARY GEOLOGIC COLUMNAR SECTION

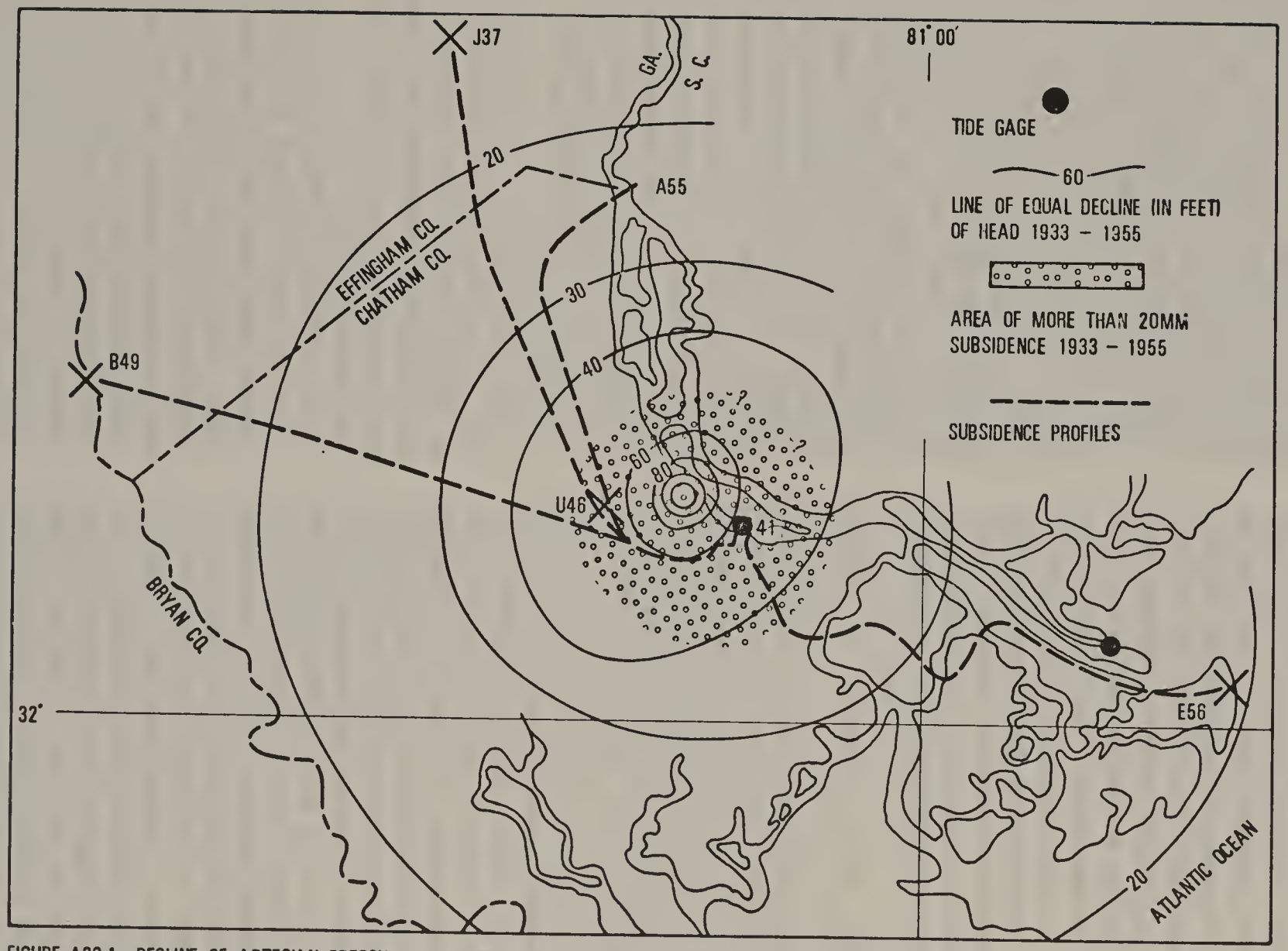


FIGURE A20.1 DECLINE OF ARTESIAN PRESSURE AND SUBSIDENCE, 1933–1955, SAVANNAH AREA, GEORGIA. (AFTER DAVIS AND OTHERS, 1963)

known for the Gulf of Mexico and make the following assumptions. Earthquakes, although very unlikely, would cause considerable damage if a quake the magnitude of the Charleston 1886 quake occurred in the area. Platforms constructed in the OCS could be damaged by movement of their supporting material. This movement can occur by sediment transport either by scour or by mass movement and by collapse of sea floor rocks related to solution cavities. Trenching or drilling into the zones of groundwater aquifers can release artesian flow and cause loss of head and subsequent salt water intrusion. Hazards such as creep, slumping gasification, subsidence and near surface faulting all of a lower order of concern in this area in comparison to the Gulf of Mexico. It is speculative at this time to state that hazardous geopressures can be expected. However many wells penetrating the Mesozoic rocks in the State of Mississippi have encountered geopressures.

7. U.S. South Atlantic Overview of Geologic Resources

The following information has largely been taken from the USGS open file report No. 75-411 Dillon et al. 1975; because of the excellent drilling summary on the continental margin and complete discussion of the hydrocarbon potential for the U.S. South Atlantic Outer Continental Shelf.

a. Drilling on the Atlantic Margin

Except for shallow core holes, there have been no wells drilled on the U.S. South Atlantic Continental Shelf. If, however, we consider the Atlantic Continental margin of the U.S., numerous deep wells have been drilled. These include about 50 wells in North Carolina (Richards, 1967) including a 3,064 m deep well drilled on Cape Hatteras only 35 km west of the Continental Slope; 11 wells in South Carolina (Olson, 1973); 148 wells in Georgia (Pickering, 1974); and many wells on the Atlantic and Gulf coasts of Florida.

Hydrocarbon shows have been reported in wells in southern Georgia along with a few oil seeps in central Georgia. The J. R. Sealy No. 3 Spindle Top in Seminole County reported oil and gas shows and the Sealy No. 1 Fee in Decatur tested a small amount of gas. A Carpenter Oil Company well in Coffee County and the Parsons and Hoke No. 1 Spurlin reported in the vicinity of Scotland in Telfair County where 30 API gravity oil and gas escape from surface sands and clays of probable Oligocene age (Maher, 1971). In northern Florida, the St. Mary's River Oil No. 1 Hilliard Turpentine in Nassau County was reported to have questionable asphaltic staining in the Cedar Keys Limestone (Paleocene), and the Taylor-age limestone and Atkinson Formation (Upper Cretaceous) (Figure A-21). On the Gulf coastal province of Florida, eight small fields have been discovered in the South Florida Embayment and large hydrocarbon discoveries have been made in the Jurassic strata at Jay Field in northwest Florida with reserves estimated in excess of 345 million bbls (McNabb, 1975).

In summary, although discoveries have been made on the Gulf coast of Florida, in the immediate vicinity of the Southeast Georgia Embayment, no commercial production of oil and gas has been established. The lack of production in the South Atlantic coastal province has been explained by many reasons. For coastal North Carolina and Georgia, the sedimentary section is mostly non-marine. For South Carolina, the basement rock is at a relatively shallow depth. The reasons for the poor production history for the Atlantic Coast of Florida could include a lack of effective porosity and permeability, lack of source beds, lack of sufficient subsurface temperature needed to transform organic molecules into petroleum and even the difficulty of seismic exploration (Reel and Griffin, 1971).

b. Potential hydrocarbon traps (areas of accumulation)

The depositional environment and tectonic history of the South Florida Embayment appear to be similar to the southeast Georgia Embayment; the hydrocarbon potential of the Southeast Georgia Embayment and the South Florida Embayment may be similar.

(1) Stratigraphic traps: The facies change between downdip marine carbonate and updip marine clastics may provide potential stratigraphic traps. This type of trap could occur along a depositional strike as the predominantly carbonate section in the Bahamas grades northward into predominantly clastic section of the Carolinas.

Signification lateral variations in porosity and permeability may occur within the thick marine carbonates of Jurassic and Cretaceous age.

Updip pinch-outs of Jurassic and Cretaceous clastic units, especially in near-shore off the coasts of South and North Carolina, offer possibilities for stratigraphic traps.

Carbonate banks and reef traps may be developed on the Florida-Hatteras slope and on basement highs, such as the Cape Romain anomaly.

Unconformities have been suggested as possible hydrocarbon traps in the southeast Georgia Embayment (Maher, 1971, Spivak and Shelburne, 1971, and Olson, 1973).

(2) Structural traps: Significant petroleum traps could be located on structural highs associated with draping and differential compaction over basement blocks. Early Jurassic sediments in this embayment were deposited on a highly block faulted basement surface. Such structures would have provided timely traps for hydrocarbons generated in Jurassic or Lower Cretaceous age rocks. Drape structures over basement blocks have provided substantial petroleum traps in other parts of the U.S. such as the giant panhandle—Hugoton field of Texas, Oklahoma and Kansas (Pippin, 1970).

Low relief anticlines should not be overlooked as potential traps in the southeast Georgia Embayment. Although difficult to locate without detailed seismic coverage, this type of trap could be significant. In the Sunniland Field of Florida, petroleum is presently being produced from low relief anticlines with as little as 11 m of closure (Myerhoff & Hatten, 1974).

Continued movement of basement blocks during Jurassic and possibly during lower Cretaceous time may have resulted in fault traps. If such traps exist, they are in the lower part of the sedimentry section.

c. POTENTIAL SOURCE AND RESERVOIR ROCKS

(1) Paleozoic: Pre-Cretaceous rocks have few characteristics of petroleum producing beds. Paleozoic rocks in pre-mesozoic basement are highly metamorphosed except in southwestern Georgia and Central Florida where they are so highly indurated and folded as to have doubtful reservoir characteristics (Maher and Applin, 1971).

(2) Mesozoic: Triassic rocks exhibit many continental aspects, such as red beds and conglomerates, and numerous igneous intrusions; such rocks may contain good reservoirs, but they are not generally regarded as good source rocks (Maher and Applin, 1971).

(3) Mesozoic: Upper Jurassic—Lower Cretaceous sediments in excess of 4000 m are expected on the continental shelf of the Southeast Georgia Embayment. These beds offer the most promising prospects for oil and gas production in the Atlantic Coastal Region (Maher and Applin, 1971).

The Jurassic section is a prolific producer in the Gulf Coast and in the Jay Field in northwest Florida. Maher (1971) believes that porous dolomitic and oolitic limestone beds of Jurassic age may occur at depth offshore. The ESSO-Hatteras Light No. 1 well penetrated 280 m of Late Jurassic rocks which Brown et al. (1972) has described as predominant coarse sand and shale. Three deep wells in the Bahamas penetrated Late Jurassic (Portlandian or Early Cretaceous (Neocomian) rocks. Although not many thick shale beds have been drilled in the sequence as yet, adequate sealing beds may be provided by dense limestone and anhydrite beds. The "black marine Jurassic shale" reported from the Great Isaac No. 1 well may furnish source beds for the above mentioned reservoir rocks.

With the exception of the recent Jurassic discoveries in northwest Florida-southwest Alabama, the Lower Cretaceous section contains the only producing strata in the immediate area and is expected to offer the best possibility for hydrocarbon entrapment in the offshore Southeast Georgia Embayment. There are three main reasons for this: (1) availability of seals to prevent the vertical migration and possible loss of hydrocarbon to the surface, (2) good reservoir rocks, and (3) possible hydrocarbon source rocks.

The warm shallow waters of the Early Cretaceous seas were conducive to anhydrite deposition on the stable southeast Atlantic continental shelf from Cape Hatteras to Cuba. Minor amounts of Lower Cretaceous anhydrite have been reported in the Esso No. 2 North Carolina well (Spangler, 1950) and the Hatteras Light No. 1 well (Brown et al., 1972), and alternate beds of Lower Cretaceous limestone, dolomite and anhydrite have reported in the Chevron Great Issaco No. 1 well (Meyerhoff and Hatten, 1974). Seaward from the Georgia coast and between these two wells, there is a good chance of encountering Lower Cretaceous anhydrite which would make an excellent hydrocarbon seal. Thin layers of shale would also make adequate seals. Although great thicknesses of Lower Cretaceous shale are not expected, not much is needed. It is worth noting that only 30 m of shale over the

crest of Burgan field, Kuwait, seals 62 billion bbls of oil (Kamen-Kaye, 1970).

The downdip Lower Cretaceous carbonates are expected to have adequate porosity and permeability. Thirty-seven porosity and permeability measurments were made for Lower Cretaceous rocks from the Hatteras Light No. 1 well (Spangler, 1950; Maher 1971). The average porosity and permeability based on these measurements are 26.1% and 487 md, respectively. Within Sunniland field, the porosity of the producing zone ranges from 15 to 24.5% and permeability average 312 md parallel to the bedding and 84 md perpendicular to the bedding (Pressler, 1947). Within the Lower Cretaceous Sunniland Limestone near Miami, porosity ranges from 6.5 to 23.3% and permeability between 0 and 2.3 darcys (Meyerhoff and Hatten, 1974). Cavernous porosity has been reported in a well drilled on Andros Island, Bahamas (Meyerhoff and Hatten, 1974) and the Esso No. 1 Hatteras Light (Maher, 1971).

If it extends beneath the shelf in the Southeast Georgia Embayment area, the thick, black marine Jurassic Lower Cretaceous shale penetrated in the Great Isaac well and DSDP Holes 101 and 105 might provide an excellent source rock for overlying permeable Lower Cretaceous dolomites and limestones.

The largest geographic separation (over 1,000 km) between DSDP Hole 101 and 105 suggest broad areal distribution of these Albian through Cenomanian organic-rich clays in the western North Atlantic. Whether these beds exist beneath the shelf can only be answered by deep-drilling. Even if these beds do not extend under the shelf of the Southeast Georgia Embayment they could still be a potential source of petroleum for shelf reservoirs because of long distance migration. It should be added that the quantity of organic-carbon content of a rock by itself does not assure its source rock properties (Fuloria, 1967) the convertibility of the organic matter to petroleum and the efficiency of oil explusion are also important. The authors are not aware of evidence that indicates that these Lower Cretaceous deepwater clay deposits of the Western North Atlantic are associated with any commercial assumulations of hydrocarbons. Other potential Lower Cretaceous source rocks include organic rich carbonate muds which were not oxidized before burial. Winston (1971) has stated that the Lower Cretaceous Sunniland Limestone has good carbonate source rocks. According to Rona (1970), the sedimentation rate during the Lower Cretaceous was relatively fast on the southeastern continental margin of North America and northwestern Africa; hence hydrocarbon precursors may not have been exposed to oxidizing conditions for extended periods of time Preliminary work by Fischer and Arthur (1975) suggests that on a world-wide basis, the Lower Cretaceous may not have been a period of extensive marine sediment oxidation. In their discussion at the 1975 AAPG-SEPM annual meetings, Fischer and Arthur presented data which indicate that the Albian, and to a lesser degree, the Aptian, was a time of deposition of extremely non-oxidized sediments. It may have been a time of reduced oceanic circulation or a time when high rates of organic productivity overwhelmed the available oxygen. In connection with the latter point, flourishing marine organisms could have created their own bottom-reducing conditions, (Hedberg, 1964). In general, the data of Fischer and Arthur suggests that this was a time of warmer temperatures, high faunal diversity, and heavy carbonate carbon isotopes.

Mattick (1974) has speculated on the possiblity of Lower Cretaceous reef reservoirs occurring along the shelf edge in the Baltimore Canyon trough. Seismic evidence indicates that reefs could occur along the shelf edge in the Southeast Georgia Embayment area also. The importance of reefs in petroleum accumulation apparently is due to the fact that they furnished timely, high porosity reservoirs near favorable source areas (Hedberg, 1964). In this case, shelf edge reefs might be potential reservoirs, not only for petroleum generated on the shelf, but also, if we appeal to the concept of long distance migration, for petroleum generated on the slope. In this connection, the suggestion of Emery (1963) that sediment which slided to the foot of the slope might create rich source material should be considered. Conversely, however, Meyerhoff and Hatten (1974) are not impressed with the reservoir potential of shelf edge reefs off Florida. According to these authors, the Atlantic Ocean has been able to flush the exposed reefs of the Bahamas area since its early history. Whether Lower Cretaceous reefs could or could not have generated petroleum is open for debate.

During Late Cretaceous time, silts and clays could have been transported to the continental slope by currents through the Suwannee Channel

and could have sealed the Lower Cretaceous reefs. In addition, alternating marine regression and transgression during lower Upper Cretaceous time (Rona, 1970) could have provided a favorable environment for deposition of clay and silt over the reefs.

Lower Cretaceous fore-reef deep-water shales and/or limestones of the U. S. Atlantic coast might have been capable of generating hydrocarbons, similar to conditions Meyerhoff and Hatten (1974) have suggested for the Golden Land Fields of Mexico. Deep-water Early to Middle Cretaceous Tamabra Limestone and Tamaulipas Limestone of the Tampico Embayment of Mexico (Coogan, 1972) possibly contained the original materials that were transformed into petroleum for the giant reserves in the Golden Land Fields which produce from the shallow water reef limestone of the El Abra Formation (Meyerhoff and Hatten, 1974).

(4) Upper Cretaceous: Very stable shallow-water shelf conditions persisted throughout most of Upper Cretaceous time. Sedimentation rates were much slower than during Lower Cretaceous time. These two factors are not conducive to hydrocarbon generation. Organic matter that may have been deposited, either land derived or marine, was probably oxidized before it could be preserved. Ernst (1974) stated that sediments (carbonates, orthoquartzites, etc.) on continental shelves of the Atlantic type accumulate in an environment that promotes exidation and solution of unstable lithic, biogenic and mineral grains and the formation of secondary quartz and carbonates. Meyerhoff and Hatten (1974) take a negative view regarding the hydrocarbon potential of Late Cretaceous rocks, at least in the Bahamas sediment, because "there are no seals in evidence to protect a reservoir, once formed". They did indicate, however, that this may not be true in the Little Bahama Bank area where they believe terrigenous clastic rocks may extend upward into the Tertiary.

Rainwater (1971) summarized the petroleum potential of the Upper Cretaceous by stating that the tectonic and sedimentary history of peninsular Florida and adjacent continental shelves during the Late Cretaceous time was not favorable for oil and gas generation. Though many porous carbonate rocks and sandstones are present, they are not likely to contain petroleum accumulations.

Maher (1971) is more optimistic in his assessment of Upper Cretaceous rocks. He believes that thick marine source rocks may be expected beneath the shelf and writes that the Upper Cretaceous rocks have good possibilities for oil and gas production beneath the continental shelf.

(5) Tertiary: the Tertiary strata of this embayment offers little hope for commercial quantities of petroleum. There is a lack of sealing beds within the Tertiary strata (Meyerhoff and Hatten, 1974; Cramer, 1974). The section is less than 1,000 m thick (Scott and Cole, 1974), contains fresh-to-brackish water, and crops out in part along the continental shelf and Blake Plateau. Any indigenous oil that may have formed has probably been flushed out by fresh waters.

Reported shows of oil or gas in the Tertiary strata of Florida are rare (Winston, 1971). In three JOIDES holes drilled offshore Jacksonville, "oil odors and asphalt specks" have been reported (Schlee and Gerard, 1965, Emery and Zarudzki, 1967). Hollister et al. (1972) reported "a substantial amount of gas, consisting primarily of methane with a trace of ethane" for DSDP Hole 103 drilled on the southwest flank of the Blake-Bahama Outer Ridge.

D. OCEAN MINING

Studies of coastal processes and morphology have uncovered considerable (although not completely evaluated) indications presently subeconomic mineral resources. Phosphates, sand, gravels and ceramic muds (Manheim, 1972) may be the most likely to incur future economic development. Table A-2 lists these surface or near surface resources of the coastal zone. Sand and gravel are the most likely deposits economic extractions on a large scale. Dillion et al. (1975) reported that U.S. Atlantic OCS estimated reserves of 450 to 4,500 billion tons of dry sand and 1.4 to 50 billion tons of gravel. Phosphate mines are in operation in the coastal zone in Florida and North Carolina, however, the future of phosphate mining in the Atlantic OCS is presently uncertain.

8. Geologic and Bathymetric Mapping Status

Geologic and topographic mapping is coordinated between the state geologists and the U. S. Geological Survey (USGS) with geologic mapping normally performed by the states and topographic maps printed by the USGS. The geologic information for those areas above sea level was taken from the American Association of Petroleum

TABLE A-2

Data sources for resources other than oil and gas for the South Atlantic OCS

Material	Selected Data Sources
Phosphorite	Stanley et al. (1967); McKelvey and Wang (1969) Manheim (1972); Milliman (1972); McKelvey et al. (1969)
Anhydrite	McKelvey and Wang (1969)
Manganese nodules - including trace elements: Ni, Cu, Co, Sn, Fe, Zn, Ag, Ba, Al, B, Ti, V, Ar, and many others	McKelvey and Wang (1969); Horn and Delach (1973); Mero (1965); Horn (1972); Manheim (1972)
Ilmenite, monzaite, zircon, staurolite, kyanite, sillimanite, and garnet	Trumbull et al. (1958); McKelvey and Wang (1969); Emery and Noakers (1968); Hathaway (1971); Manheim (1972); Ross (1970); McKelvey (1969); McKelvey (1969); Manheim (1972)
Copper and zinc (chalcopyrite and sphalerite minerals)	Manheim (1972)
Sand, gravel and mud	Manheim (1972); Schlee (1974, 1968); Schlee and Pratt (1970); Emery (1965); Duane (1968); Davenport (1971); Taney (1971); Economic Associates Inc. (1968); Milliman (1972); Ross (1970); McKelvey and Wang (1969); Nossaman (1969); Doumani (1973); Rexworthy (1968)
Glauconite	McKelvey et al. (1969)
Carbonate	Hillsemann (1967); Milliman (1972)

Source: Dillion et al., 1975.

Geologists (AAPG) Geological Hishway Map series. These maps were compiled by Renfro Feray (1975) for the South Carolina, North Carolina and Virginia areas and Bennison et al. (1975) for the Georgia and Florida areas, with the cooperation of the U. S. Geological Survey. The AAPG maps were compiled from the latest state and federal information available as noted in their sections "Principal Sources of Map Information" (Table A-3) Other principal sources are also listed in Table A-3. Mapping of the upland Geology is adequate for the scale used (i.e., 1:1,000,000). All of the states have programs whose goal is to update existing geologic maps. Geologic mapping in the offshore areas is inadequate. Maps that are available, such as the map by Uchupi (1965) (Figure A-22) are usually quite generalized. The most detailed information is the JOIDES prolife by Emery and Zarudzki (1967); therefore, Visual No. 2 N-S is very generalized for the offshore area. The U.S. Geological Survey is at present, preparing an offshore geologic map for this region.

Bathymetric mapping for the offshore regions of the proposed sale is also inadequate. Generalized maps by Uchupi (1966) and by Holland (1970) are now dated and are difficult to use in detailed investigations at the 1:1,000,000 scale. Of the 27 proposed bathymetric maps adjacent to the coasts of North and South Carolina, Georgia and Florida, only one 1:250,000 map, Figure A-23, has been printed by National Ocean Survey (NOS). This map is the Beaufort, N. C. sheet and is detailed from modern data. Three other sheets (Savannah, Brunswick and Jacksonville) are scheduled for printing in 1976.

9. Geological Data Requirements

As part of the BLM environmental studies program, the U.S. Geological Survey Office of Marine Geology over the last year has been conducting geological and geophysical research. This research is designed to obtain up-to-date information on potential shallow hazards, sediment transport, trace metal and hydrocarbon content of surficial sediments, and to learn more about the history of the U.S. South Atlantic Continental Shelf.

In order to evaluate potential shallow hazards, uniboom, minisparker, and 3.5 KHz echo sounder systems profiles have been obtained across the U.S. South Atlantic shelf.

A. BATHYMETRIC MAPS

Requirements for accurate bathymetric maps used in managing offshore oil and gas operations are as follows:

(1) Determination of slope gradients in mudslide areas for geologic hazards.
(2) Base maps for plotting individually reported geologic hazards, as mud lumps, gas seeps, and faulting.
(3) Determination of bathymetric features such as high and low relief areas, fishing banks, coral reefs, and other features.
(4) Determination of high probability areas for shipwrecks and submerged aboriginal (Indian) living sites.
(5) Determination of the upper and lower limits of practical use of geophysical instrumentation for archaeological and biological survey stipulations.
(6) Depth requirements on shunting of drill cuttings.
(7) Location of favorable areas for recreational uses (such as diving and underwater parks).
(8) Base map for almost all offshore environmental information such as shoaling areas for tornadoes, cable and pipeline information for EIS and Sale Matrix.
(9) Location of favorable areas for other uses of the seafloor and subbottom.

As stated in the status of mapping for offshore U.S. South Atlantic region, the available bathymetric maps are inadequate. Figure A-24 depicts the current mapping status. Additional areas which bathymetric maps have been requested for are designated by a priority number.

B. MARINE GEOLOGIC MAPS

As noted in the section on Physiography—Continental Shelf and Slope, there is an acute need for a marine geologic map. Especially needed is an accurate depiction of the inner, middle and outer hard banks areas.

Table A-3 Sources of Map Information for the AAPG Geological Highway Map Series

Agency	Publication or Map
U.S. Geological Survey	Geologic Map of North America, 1965 Tectonic Map of North America, 1969 Tectonic Map of United States, 1962 Basement Rock Map of U.S., 1968 Geologic Map of Appalachian Region, 1968 Professional Papers of the Geological Survey
Virginia Division of Mineral Resources	Geologic Map of Virginia, 1963
North Carolina, Div. of Mineral Resources	Map of North Carolina, 1958
South Carolina	Geologic Map of the Crystalline Rocks USGS Misc. Geol. Investigations, I-413, 1965
South Carolina Division of Geology	Geologic Map of South Carolina, 1965
Florida Division of Geology	Geologic Map of Florida, 1964
Georgia Division of Geology	Geologic Map of Georgia, 1975
Princeton University Press	The Quaternary of U.S., 1965
Utah State University Press	Post-Miocene Stratigraphy of Central and Southern Atlantic Coastal Plain, 1974
U.S. Geological Survey	Bulletins, circulars and maps (CQ, I, OC, POC, POM series)

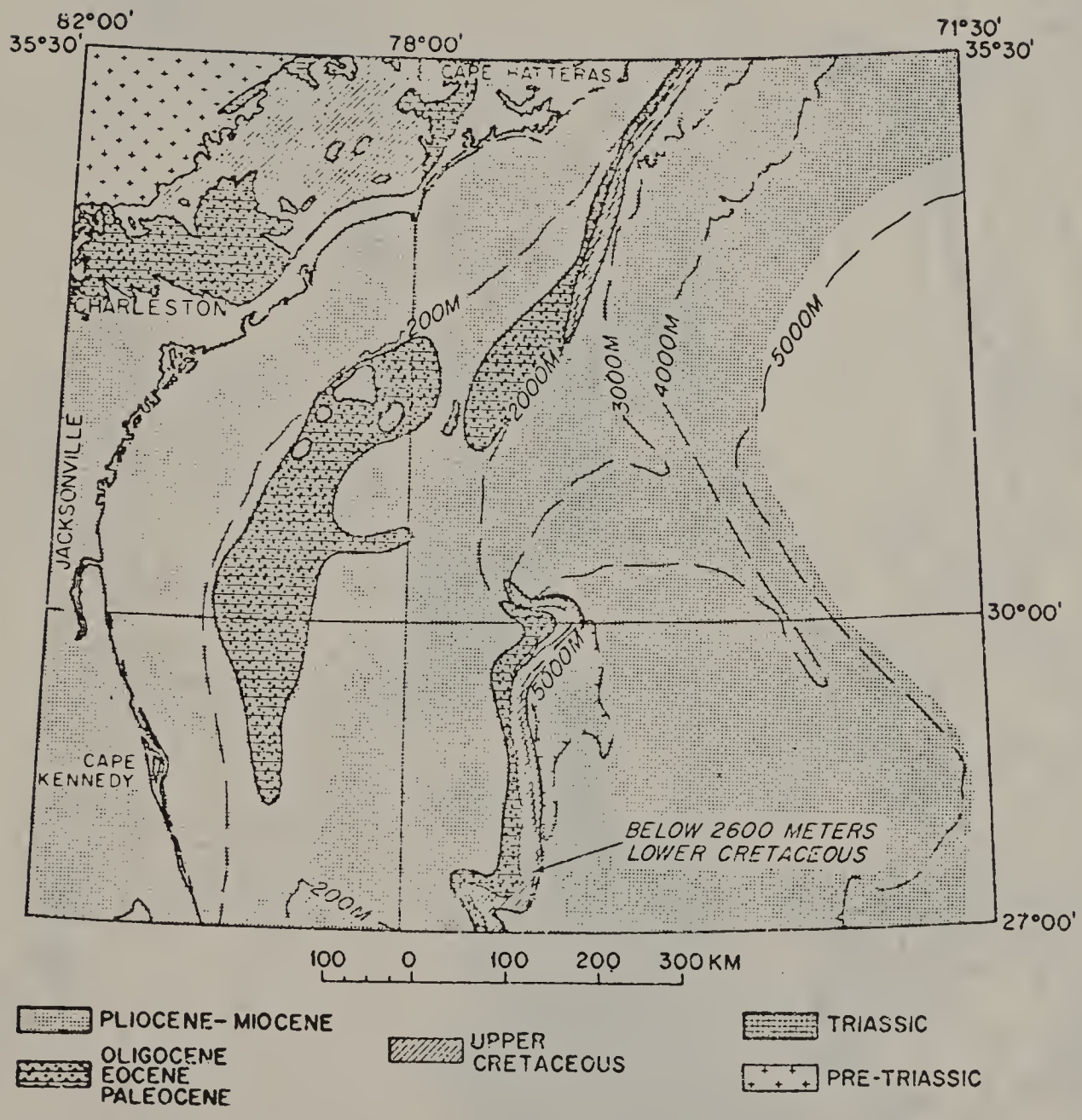
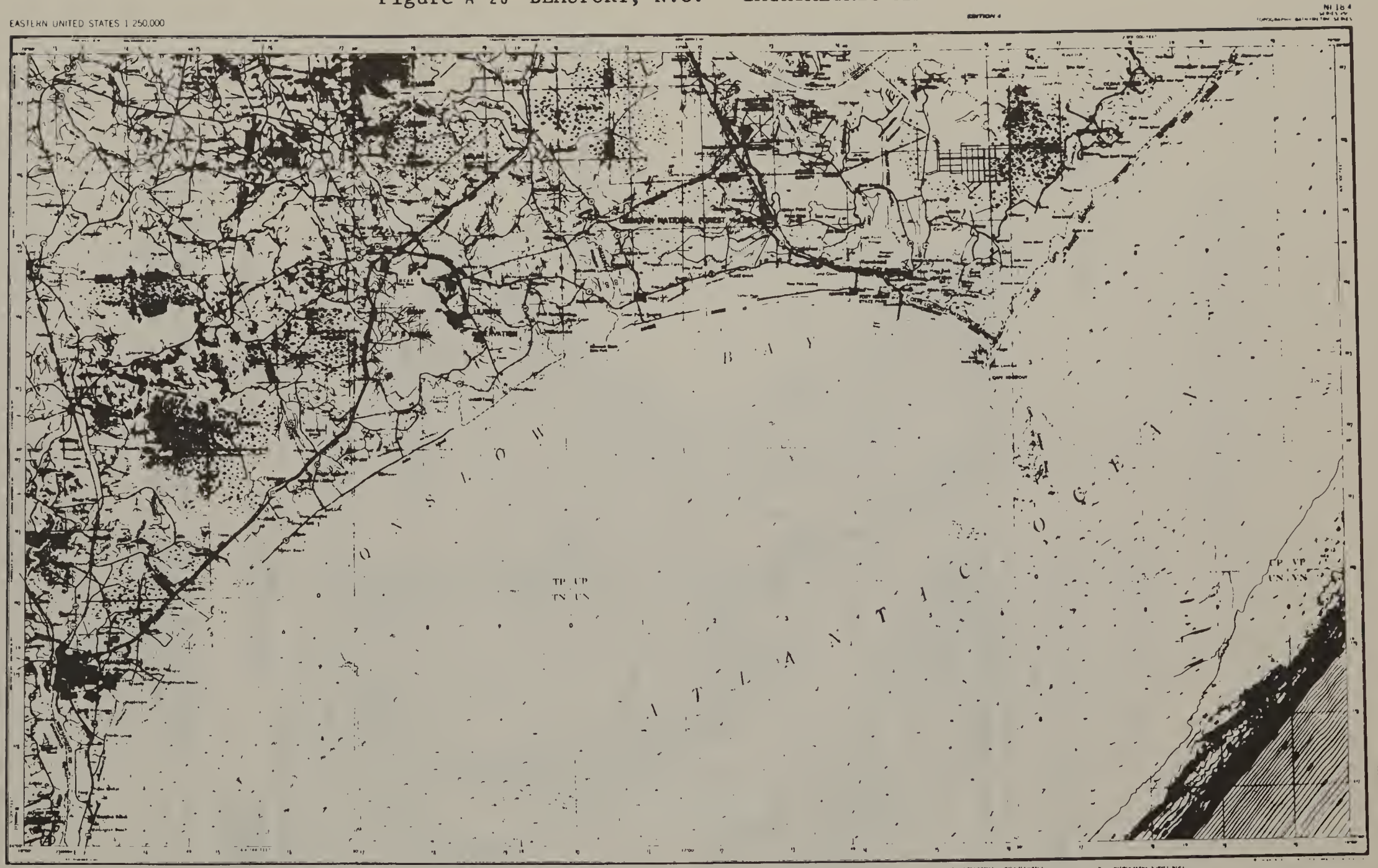


Figure A-22. Geologic map of the continental margin south of Cape Hatteras, if the Quarternary sediments were removed, Uchupi (1967).

Figure A-23 BEAUFORT, N.C. - BATHYMETRIC MAP.



UNITED STATES DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT
OUTER CONTINENTAL SHELF
GULF OF MEXICO AND ATLANTIC OCEAN

FIG. A-24

STATUS OF BATHYMETRIC MAPS AND PROPOSED NAMES

- AVAILABLE, BLM CONTRACT TO NOS
- BLM CONTRACT TO NOS 1976
- USGS-NOS TOPO BATHYMETRY
- NOS MAP 0906-14 AVAILABLE
- USGS-NOS TOPO-BATHYMETRY IN 1976
- USGS-NOS TOPO-BATHYMETRY AVAILABLE AVAILABLE 0806M-23
- △ LEASE BLOCK OVERLAY NOT INCLUDED
- ◇ PROPOSED NAME
- PROPOSED
- 7 PRIORITY OF NEWLY REQUESTED MAPS

NEW NAME EAST BREAKS OLD NAME (BAY CITY) MAP NUMBER NG 15-1

AUGUST 1976

SOURCE: BUREAU OF LAND MANAGEMENT, 1976

LOUISIANA
TEXAS
MISS.
ALA.
FLA.
MEXICO
CUBA
ISLA DE PINOS
PENINSULA DE YUCATAN
BELIZE
GREAT ABACO ISLAND
GRAND BAHAMA ISLAND
ANDROS ISLAND
JAMAICA

HOUSTON △ NH 15-7
PORT ARTHUR NH 15-8
NEW ORLEANS NH 15-9
BEEVILLE
BAY CITY
ROUMA BANK
EWING BANK (NEW ORLEANS)
CORPUS CHRISTI NH 15-10
EAST BREAKS (BAY CITY)
GARDEN BANKS
GREEN CANYON (NEW ORLEANS NO. 1)
NG 14-3
NG 15
NG 15-2
NG 15-3
PORT ISABEL
ALAMINOS CANYON (BAY CITY NO 1)
KEATHLEY CANYON (GARDEN BANK SOUTH NO 1)
WALKER RIDGE (NEW ORLEANS NO 2)
NG 14-6
NG 15-4
NG 15-5
NG 15-6
BROWNSVILLE
NG 14-9

MOBILE △ NH 16-7
VIOSCA KNOLL △ (MOBILE SOUTH NO 1)
MISSISSIPPI CANYON (MOBILE SOUTH NO 2)
ATWATER (MOBILE SOUTH NO 3)
LUNO ◇ (MOBILE SOUTH NO 4)
NG 16-1
NG 16-4
PENSACOLA NH 16-8
DESTIN DOME (PENSACOLA SOUTH NO. 1)
DESOTO CANYON (PENSACOLA SOUTH NO 2)
LLOYD ◇
HENDERSON ◇
NG 16-2
NG 16-5
TALLAHASSEE NH 16-2
APALACHICOLA
13
NH 16-9
FLORIDA MIDDLE GROUND (APALACHICOLA SOUTH NO 1)
NH 16-12
HE ELBOW (TAMPA WEST NO 1)
15
NG 16-3
VERNON ◇ (FORT MEYER WEST NO. 2)
16
NG 16-6
HOWELL HOOK
22
NG 16-9

VALDOSTA NH 17-4
GAINESVILLE
TARPON SPRINGS
SAINT PETERSBURG (TAMPA)
NH 17-10
CHARLOTTE HARBOR (FORT MEYER WEST NO 1)
17
NG 17-4
PULLEY RIDGE
18
NG 17-7
ORY TORTUGAS
20
NG 17-10

JACKSONVILLE NH 17-5
DAYTONA BEACH
4
NH 17-8
ORLANDO
9
NH 17-11
FT PIERCE
10
NG 17-2
WEST PALM BEACH
NG 17-5
MIAMI
19
NG 17-8
KEY WEST
21
NG 17-11

CURRITUCK SOUND
MANTEO
BEAUFORT △ NI 18-4
GEORGE TOWN NI 17-9
CAPE FEAR NI 18-7
SAVANNAH NI 17-11
JAMES ISLAND NI 17-12
BRUNSWICK NH 17-2
HOYT ◇ NH 17-3
NJ 18-11
NJ 18-12
HYMAN ◇
CARSON ◇
NI 18-2
NI 18-3
RUSSELL ◇
NI 18-5
MARMER ◇
NI 18-8
RICHARDSON ◇ NI 18-10
HARRINGTON ◇ NH 18-1
2
STETSON ◇ NH 17-6
1
3
JOROAN ◇ NH 17-9
5
6
PILLSBURY ◇ NH 17-12
8
7
WALKER CAY NG 17-3
11
12
BAHAMAS NG 17-6
BIMINI NG 17-9

II-41

B. Physical Oceanography

1. Estuaries

The area of the South Atlantic Coastal region from Cape Hatteras, N.C., to Cape Canaveral, Fla. is marked by both open and semi-enclosed embayments. Barrier islands with associated lagoons are typical from Cape Hatteras to Cape Fear and again from Jacksonville to Cape Canaveral. The region between Cape Fear and Jacksonville is characterized by mud flats, salt marshes and an abundance of small islands. In general, the entire area is marked by drowned river valleys, barrier islands, tidal marshes, backed by large wetlands. Fresh water run-off is fairly constant along the length of the coast but is less abundant than coastal regions to the north. Figure B-1 shows major drainage areas flowing into the Atlantic Ocean in the region of interest.

A. CHARACTERISTICS OF ESTUARIES AND CLASSIFICATION

Pritchard (1955) defines an estuary as a semi-enclosed coastal body of water which has a free connection with the open sea and within which seawater is measurably diluted with fresh water derived from land drainage. He has developed a system for classifying estuaries on the basis of salinity stratification. Several physical parameters directly influence stratification; freshwater run-off, wind, tide, and dimensions of the estuary. The following is a brief description of how estuaries are classified in the coastal region from Cape Hatteras to Cape Canaveral.

(1) SALT-WEDGE ESTUARIES

The salt-wedge estuary forms when the volume of freshwater runoff is high in relation to the tidal volume (Figure B-2). This occurs usually at the mouths of large tidally influenced river systems, such as, the Neuse River in North Carolina (Visual No. 2N) and the Cooper River in South Carolina (Visual No. 2S). The main characteristic of these estuaries is the fact that vertical mixing between salt and fresh water can only occur upward. The salinity increases constantly with distance downstream. It is possible for salt water to become entrained in the upper layer as it moves seaward thus increasing the salinity of the river water.

(2) PARTIALLY MIXED ESTUARIES

A partially mixed estuary results when tidal inflow is increased and river runoff is decreased. This type of estuary is no longer river dominated and vertical mixing occurs both upward and downward. The addition of seawater to the upper layer outflow results in an increase of upstream flow of the bottom layer. Freshwater, free of any salt, is found only at the head of the estuary. Examples include the Winyah Bay-Pee Dee River in South Carolina, the Savannah River in Georgia and the Altamaha River in Georgia (Visual No. 2S).

(3) VERTICALLY HOMOGENEOUS ESTUARIES

The vertically homogeneous estuary is usually a broad embayment with insignificant river input. In this type of embayment the salinity variance is much greater laterally and longitudinally than vertically. The Coriolis Effect causes lower salinity seaward flow to be found on the right and higher salinity tidal inflow to be found on the left. This type of estuary exhibits vertical mixing both upward and downward. The best example of this type of embayment is the Pamlico River in North Carolina (Visual 2N) (VIMS, 1974).

B. MAJOR HARBOR ESTUARIES

Data on major harbor estuaries were taken largely from information compiled by John P. Jacobson of the Virginia Institute of Marine Science in A Socio-economic Baseline Summary for the South Atlantic Region Between Cape Hatteras, North Carolina and Cape Canaveral, Florida (VIMS, 1974). Jacobson has compiled and summarized available information and provided a description of some major harbor estuaries located within the area of interest.

(1) PAMLICO SOUND

Pamlico Sound, North Carolina is 129 km (80 miles) long and from 24 to 48 km (15 to 30 mi) wide and covers approximately 4.33×10^5 hectares (1,670 mi^2) with a mean depth of 4.9 m (16 ft.).

The sound extends from Oregon Inlet to Ocracoke Inlet with additional ocean communication at Hatteras Inlet. The sound is separated from the ocean by the Outer Banks, a barrier island chain. Fresh water inflows come primarily from the Neuse-Trent River (drainage area—1.45×10^6 ha) (5600 mi^2) and the Tar-Pamlico River (drainage area—1.1×10^6 ha) (4200 mi^2). The total drainage area of Pamlico Sound is 2.9×10^6 ha (11,100 mi^2) with an average freshwater inflow of 510 m^3/sec (18,000 cfs). Evaporation is about 1 m (40 in) per year and precipitation average 1.3 m (50 in) each year.

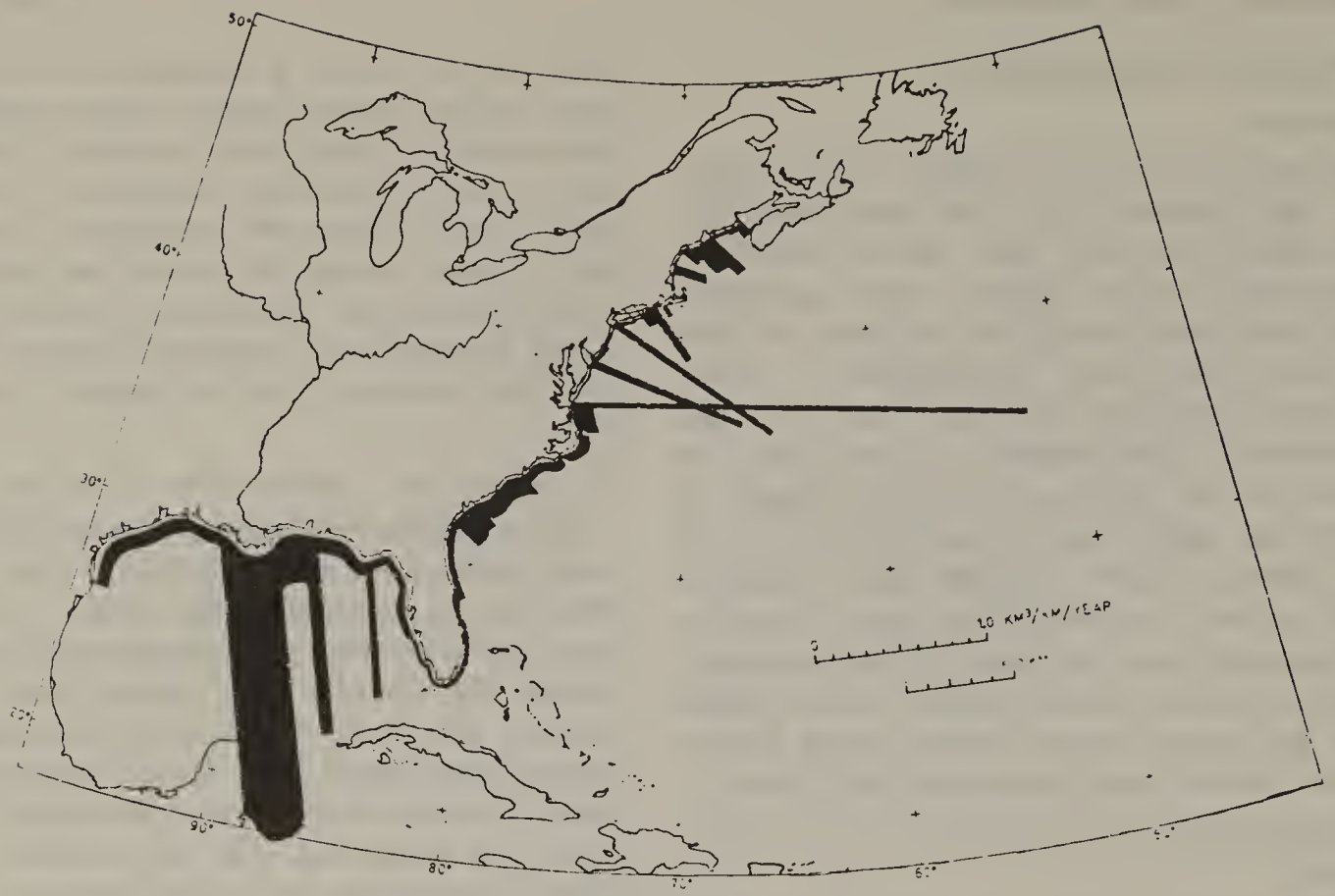


FIG. B-1 Average annual runoff to ocean in terms of km³, linear km of coast. From data of Bue (1970) and Wilson and Iseri (1969).

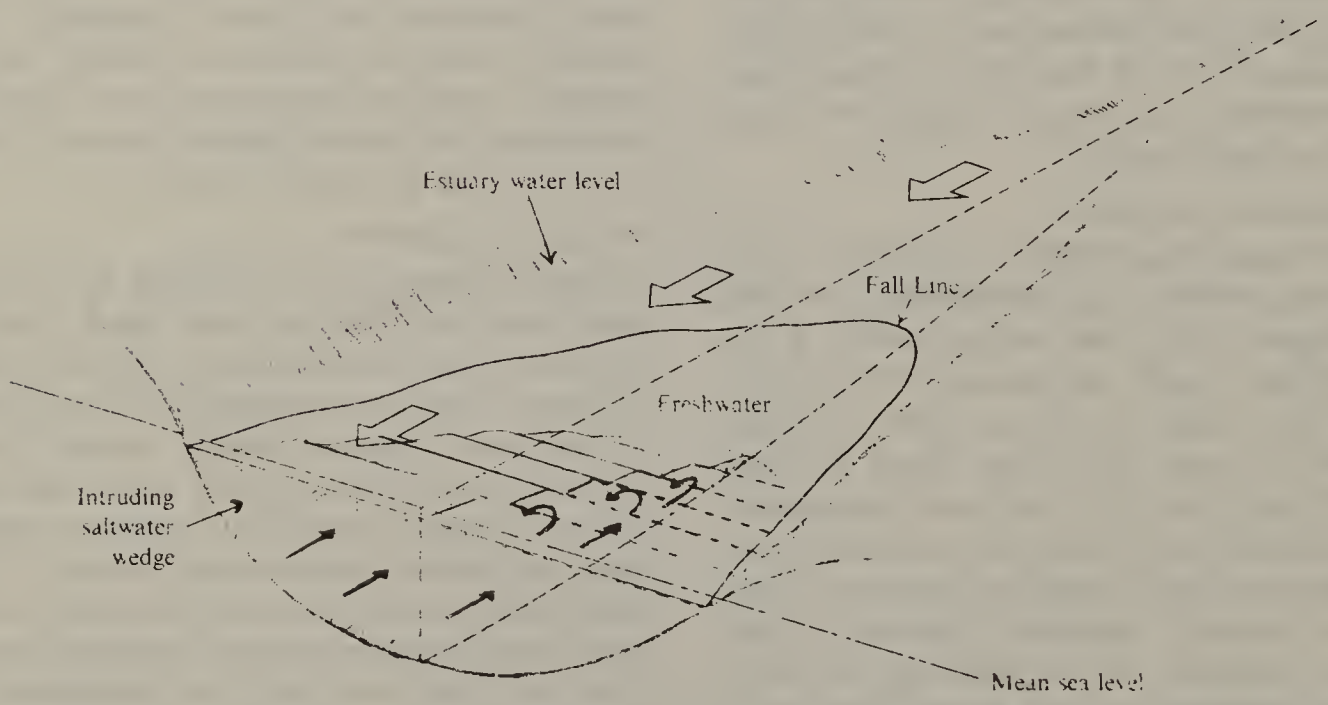


Fig. B-2 A type I estuary. The discharge of freshwater is sufficient to maintain a steep face on the intruding salt wedge. Friction between the outflowing water and the salt wedge may produce waves that break and deliver salt upward into the discharging water, a process known as salt entrainment. This friction also prevents the salt wedge from intruding upstream to its fall line. Tidal flow is small compared to freshwater discharge (Duxbury, 1971)

The sound is highly saline (average 20 ppt) with little vertical stratification (vertically homogeneous) due to its shallow depth and wind mixing. Horizontal salinity stratification is evident throughout the year with the stronger gradients in the western part of the sound due to dilution highly saline tidal inflow from the ocean. Monthly temperature and salinity distributions in Pamlico Sound have been presented by Williams et al. (1973).

There are weak currents and a negligible tidal range in the sound. The astronomical tides only average 15 cm (6 in.) but wind often will cause a change in the level of the water surface greatly exceeding this value. Roelofs and Bumpus (1953) report that the tidal exchange through the inlets is approximately eight times the average river inflow. The flushing time is approximately three months.

(2) WILMINGTON, NORTH CAROLINA

The harbor of Wilmington, N.C. is located in the southeastern part of the state, 39 km (24 mi.) from the coast on the Cape Fear River. The harbor is 280 km (151 nautical miles) northeast of Charleston and 284 km (154 naut. mi.) southwest of Morehead City, N.C. A dredged ship channel extends from the ocean to the mouth of the Northeast (Cape Fear) River at Wilmington, and then 5 km (3 mi.) up that river. The mean low water depth over the Cape Fear bar is 12.2 m (40 ft.) and of the channel at Wilmington, 11.6 m (38 ft.). The Cape Fear River is the only major river in North Carolina which flows directly into the ocean.

The Cape Fear River is a tidal estuary extending approximately 108 km (67 mi.). The estuary at Wilmington fluctuates between partially mixed and vertically homogeneous. The average freshwater inflow is 396.5 m^3/sec (14,000 cfs). Current velocities at Wilmington are approximately 1 m/sec (3 ft/sec) at strength of flood and 0.8 m/sec (2½ ft/sec) at strength of ebb. The spring tide range at Wilmington is 1.2 m (4 ft.). The mean salinity at Southport, near the mouth, for the years 1946-54 was 22.8 ppt with a mean range between 17.4 ppt in March and 26.4 ppt in October. The annual mean surface water temperature is 18.7°C (65.6°F) with a mean range from 10.9°C (51.6°F) in January and February to 29.7°C (85.5°F) in July and August.

(3) CHARLESTON, SOUTH CAROLINA

Charleston, S.C., is located on a peninsula at the confluence of the Cooper River, on the east, and the Ashley River on the west. The inflows of the Cooper, Ashley and the Wando rivers form the harbor, with the predominant inflow coming from the Cooper. The entrance to Charleston Harbor is between converging jetties which extend nearly 5 km (3 mi.) seaward. The channel to Charleston is dredged to a depth of 10.7 m (35 ft.). Charleston Harbor is 148 km (80 naut. mi.) northeast of the mouth of the Savannah River and closer to the sea than any other South Atlantic Coast port (7 mi.).

In 1942, the Santee River was diverted into the Cooper through Lake Marion and Lake Moultrie with drastic changes in the flow (170 m^3/sec. average to 510 m^3/sec.). This changed the estuary from a vertically homogeneous state to that of a highly stratified salt-wedge, with sediment particles becoming entrapped in the wedge. The result has been such an increase in the rate of sedimentation that rediversion is being considered.

The mean salinity at Charleston Customhouse Wharf for the years 1942-1958 was 17.6 ppt. The mean range was between 14.00 ppt in April and 21.0 ppt in October. The annual mean surface temperature of the water is 19.9°C (67.8°F) and the range is between 10.7°C (51.3°F) in January and 28.6°C (83.4°F) in July and August. The mean tidal range in the harbor is 1.58 m (5.2 ft.), spring 1.83 m (6 ft.), neap 1.28 m (4.2 ft.). The average freshwater inflow ranges from 510 to 566 m^3/sec. (18,000 to 20,000 cfs) and the mean discharge during ebb is 1.0×10^8 m^3 (3.6×10^9 ft^3). The water velocity is 122 to 152 cm/sec (4 to 5 ft/sec) at the surface and slightly less at the bottom at midtide.

(4) SAVANNAH, GEORGIA

Savannah, the chief port of Georgia, is located 105 km (65 mi.) south of Charleston and 169 km (105 mi.) north of Jacksonville, Fla. on the south bank of the Savannah. The deep water entrance from the ocean to the Savannah River is by way of a dredged channel approximately 26 km (16 mi.) long, 11.6 m (38 ft.) deep across the bar through Tybee Roads. The harbor, which is regulated by two upstream reservoirs, consists of the lower 30.6 km (19 mi.) of the river. The fresh water inflow averages 198 m^3 /sec (7000 cfs.).

The tides are semi-diurnal with spring tides averaging 2.74 m (9 ft.) and neap tides 1.52 m (5

ft.). The mean tidal range is 2.1 m (6.8 ft.) at the entrance to the river and 2.3 m (7.4 ft.) at the city of Savannah. The harbor carries large amounts of fresh water during spring freshets and floods. There are maximum current velocities in the navigation channels on the order of 1.52 m/sec (5 ft/sec) during ebb and 1.22 m/sec (4 ft/sec) during flood. Salinity varies from essentially fresh water in the upper portion of the harbor to coastal water at the mouth. At Fort Pulaski, near the mouth of the Savannah River, the mean salinity for the year is 17 ppt with a mean range between 12 ppt in April and 20 ppt in both August and October. At Fort Pulaski the annual mean surface water temperature was 20.3°C (68.5°F) for 1940-1966 with a mean range between 10.9°C (51.6°F) in January and 28.9°C (84.0°F) in August. The harbor estuary may be classified as partially mixed according to Pritchard's classification.

(5) JACKSONVILLE, FLORIDA

The port of Jacksonville is located in northeastern Florida on the St. Johns River, 169 km (105 miles) south of Savannah, Ga. The deep water entrance to the river is located between east-west jetties across the ocean bar from the river mouth. A dredge channel of 9.14 m (30 ft.) extends from the entrance to the St. Johns to Jacksonville. The waterfront facilities are located on both banks of the lower 39 km (24 mi.) stretch of St. Johns.

The river at Jacksonville may be classified as vertically homogeneous. There is almost complete vertical mixing during the entire tidal cycle. The salinity at Jacksonville varies from 0 to 15 ppt, with salinities generally higher in May and June and lowest in October and November on the average. Salt-water intrusion is 62.8 km (39 mi.) above the river entrance. Mean flow of fresh water is 374 m^3/sec (13,200 cfs).

The average river water temperature over a 20 year period at Jacksonville was 22.8°C (73°F) (Bostwick et al. 1948), with a general decrease in temperature progressively downstream. The mean range of surface water temperature between 1955 and 1959 was between 14.1°C (57.4°F) in January and 30.6°C (87.3°F) in July.

Tides in the harbor are semi-diurnal. The mean tidal range is 1.5 m (4.9 ft.) on the bar and 0.4 m (1.2 ft.) at Jacksonville. Strong winds greatly affect tide levels. Tidal currents are strong in St. Johns River upstream to Jacksonville. Channel velocities at the strength of the current are approximately 0.4 m/sec (4.8 ft/sec) at the mouth and approximately 1.2 m/sec (3.8 m/sec) at Jacksonville. The ebb tide velocity is increased and the flood velocity decreased or interrupted by strong southeast winds.

2. Water Temperature

The surface water temperatures of the western North Atlantic, south of Cape Hatteras, are directly dependent upon seasonal air temperature. During winter, surface water temperatures decrease from the relatively warm Gulf Stream toward the coast. During spring this gradient weakens until summer, when temperatures are essentially isothermal across the shelf. The sequence of seasonal surface water temperature variation and the average annual range can be seen in Figures B-3 through B-6 (Schroeder, 1966).

The bottom temperature contours for the Continental Shelf waters generally parallel the coast (Figures B-7 through B-10). Bottom water temperatures near the coast are almost isothermal throughout the year due to wind mixing (Newton et al., 1971). They also show a large annual range, near the coast, because of the effect of seasonal air temperatures. At the shelf break, bottom water temperatures can be warmed by Gulf Stream intrusion or chilled by cooler nearshore water sinking and sliding down the shelf. In general, bottom water at the shelf break shows a much smaller temperature range than surface water for two reasons. The water at this depth is not directly affected by changing air temperatures and lies below water that is mixed by surface winds.

Newton et al. (1971) reported that minimum horizontal gradients and maximum vertical gradients of temperature occur during summer along the U.S. south Atlantic Coast. During the winter the situation is reversed with minimum vertical gradients and maximum horizontal gradients of temperature. Figures B-11 through B-17 illustrate the horizontal and vertical temperature gradients as they vary seasonally on the shelf between Cape Lookout, N.C. to Cape Canaveral, Fla. These T. N. Gill Data are the most complete temperature information published in the proposed sale area (VIMS, 1974).

3. Circulation

A. WATER MASSES

Kuroda and Marland (1973) using data from the T. N. Gill cruises identified four different water

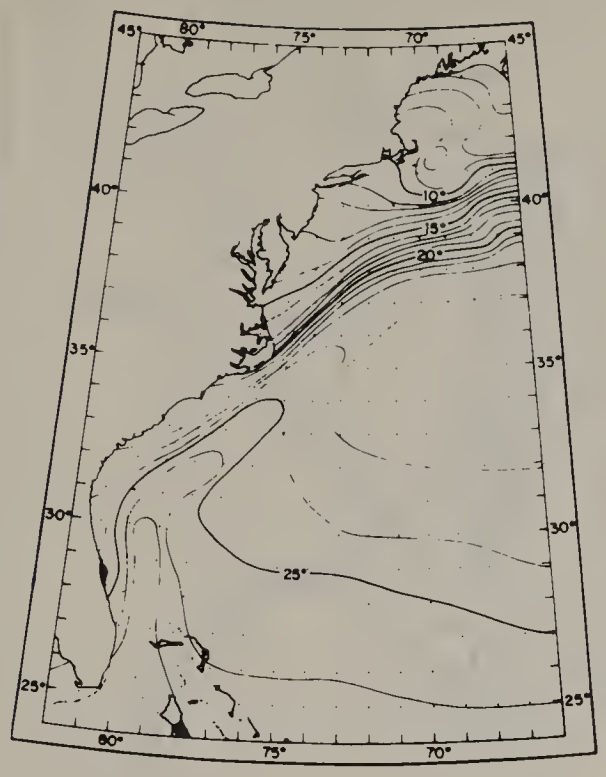


Figure B-3 Average spring surface temperature (°C), 61,787 observations (Schroeder 1966).



Figure B-4 Average summer surface temperature (°C), 50,668 observations (Schroeder 1966).

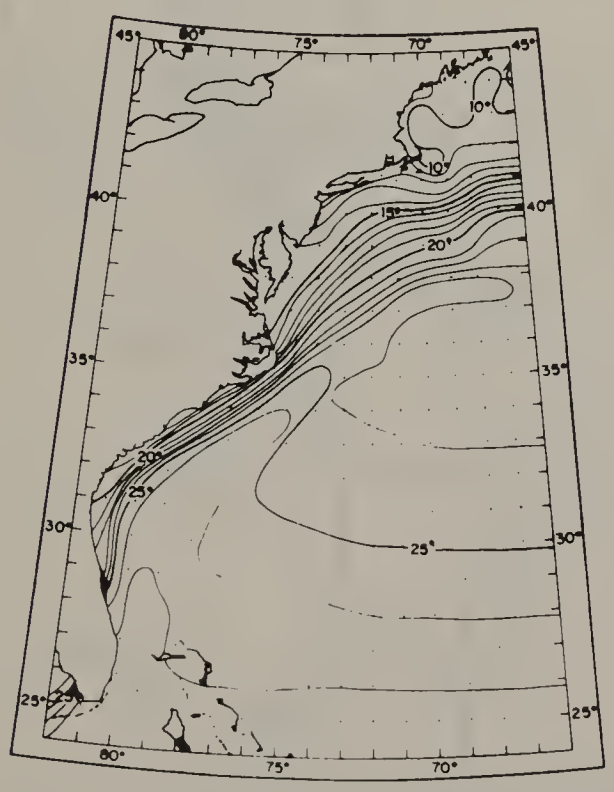


Figure B-5 Average fall surface temperature (°C), 39,123 observations (Schroeder 1966).

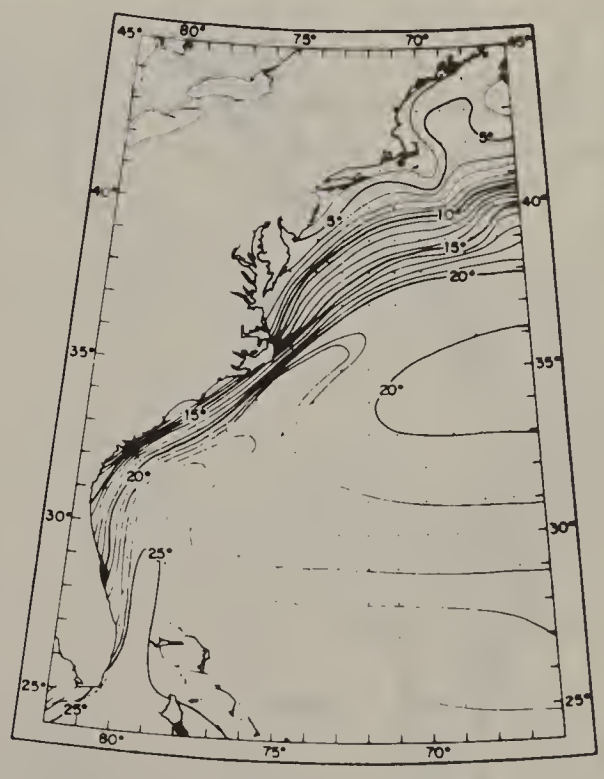


Figure B-6 Average winter surface temperature (°C), 40,052 observations (Schroeder 1966).

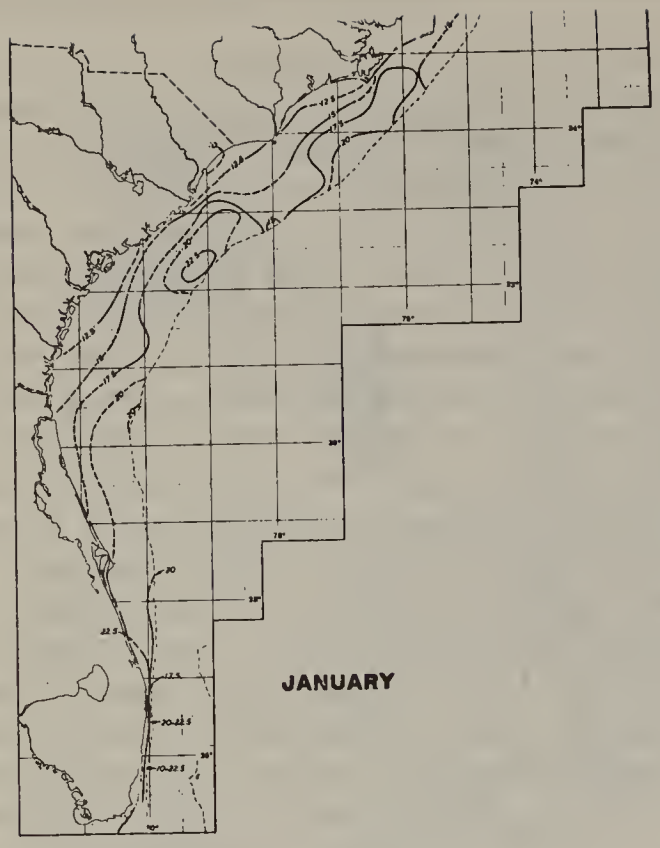


Figure B-7 Bottom temperatures (°C) on the Continental Shelf, January (Walford and Wicklund, 1968).

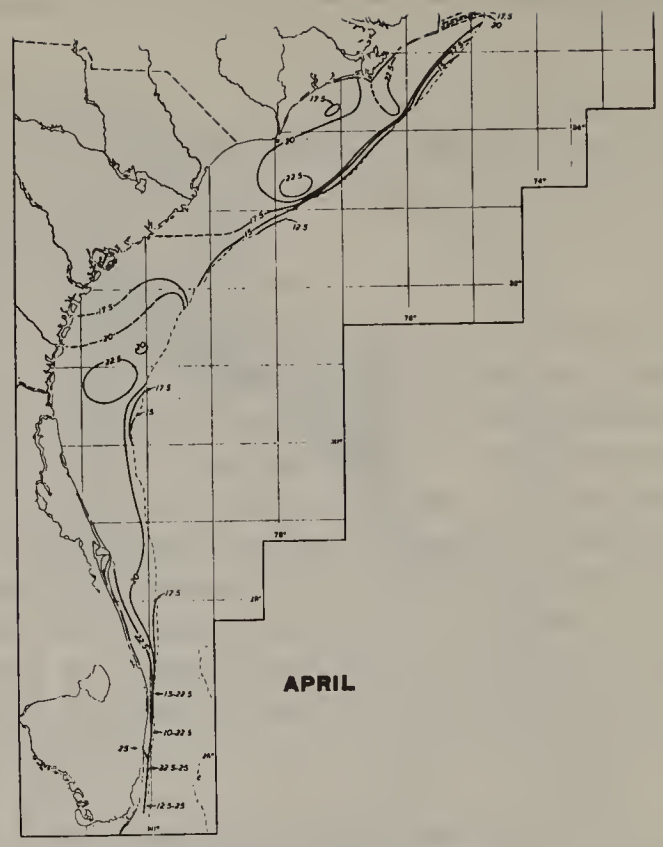


Figure B-8 Bottom temperatures (°C) on the Continental Shelf, April (Walford and Wicklund, 1968).

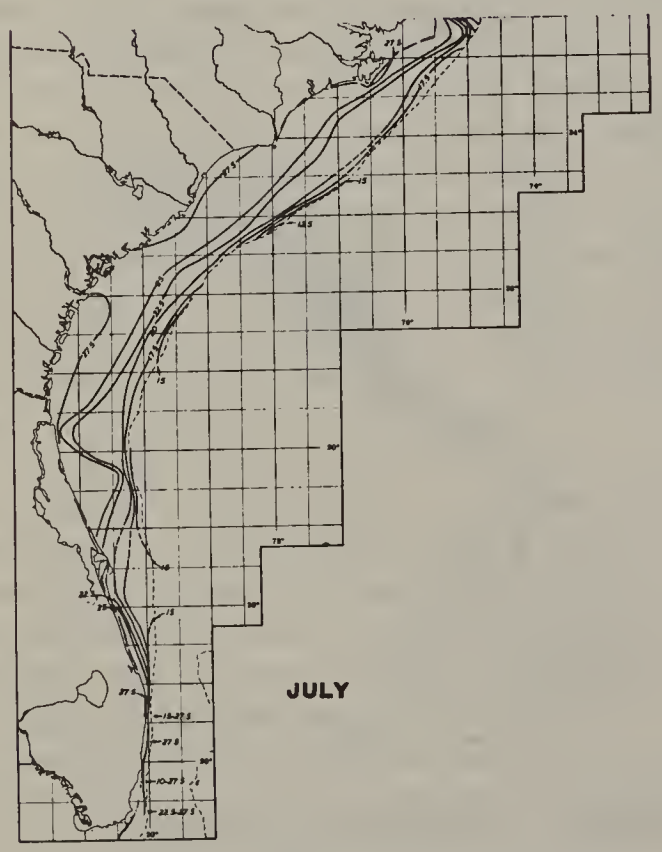


Figure B-9 Bottom temperatures (°C) on the Continental Shelf, July (Walford and Wicklund, 1968).

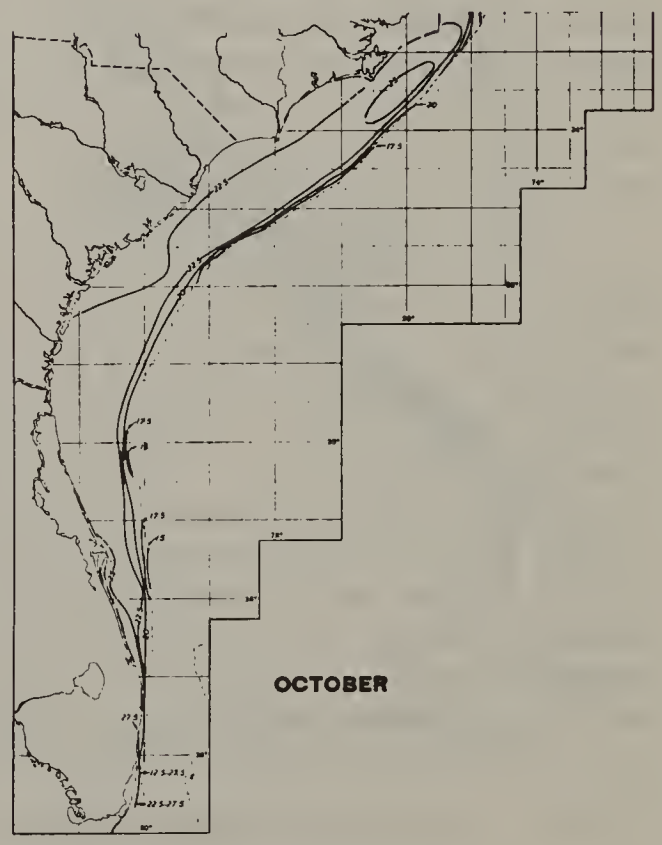


Figure B-10 Bottom temperatures (°C) on the Continental Shelf, October (Walford and Wicklund, 1968).

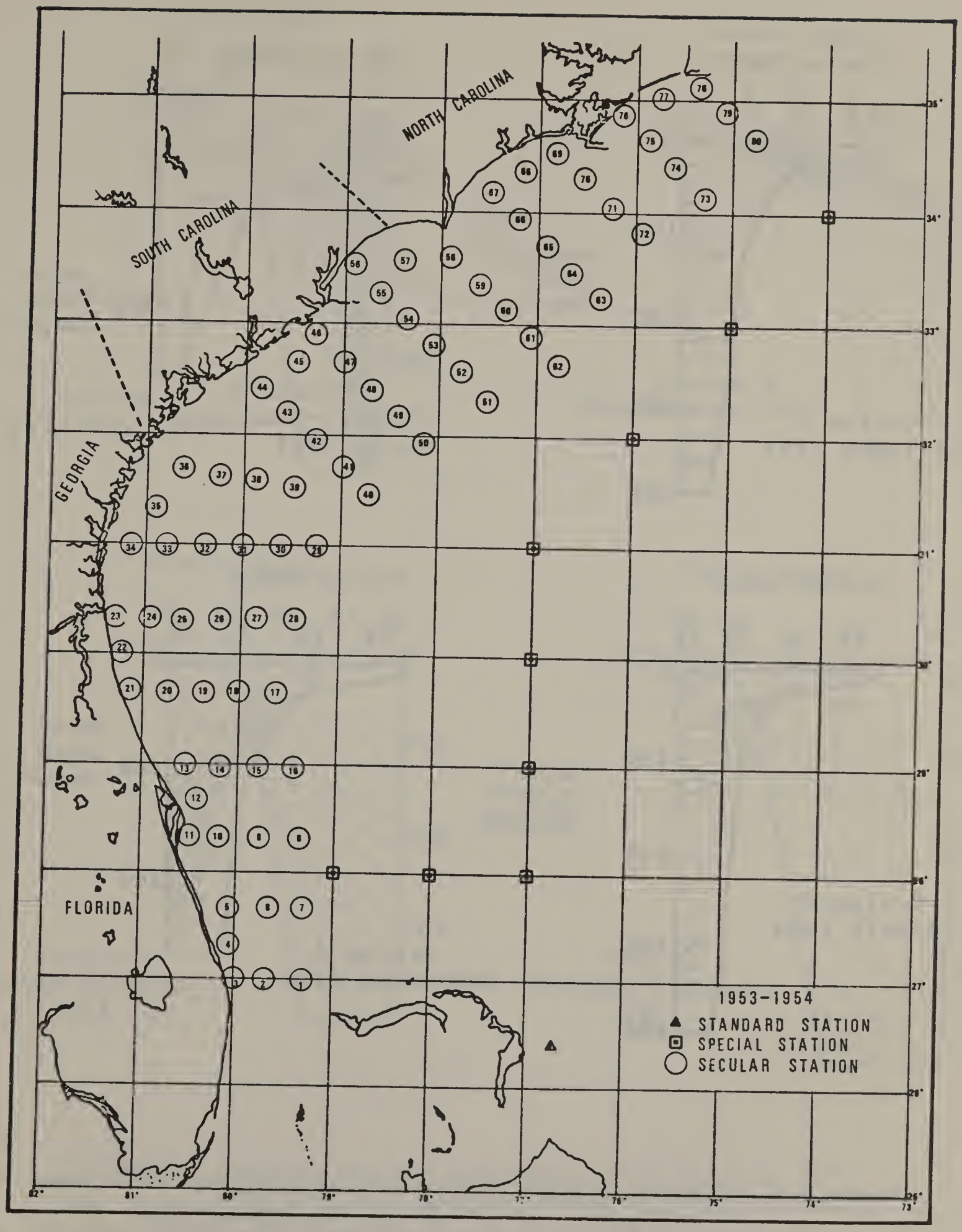
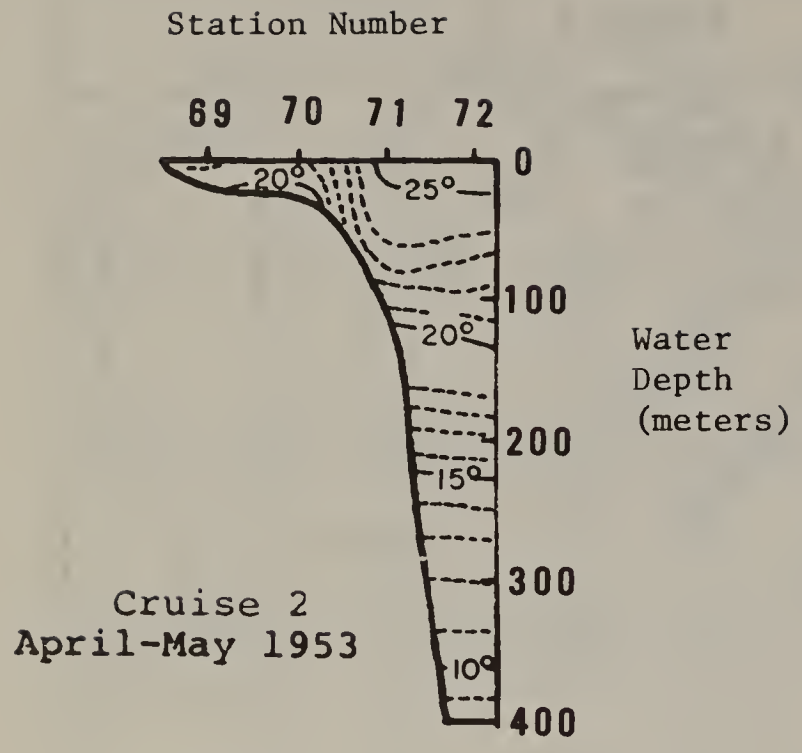
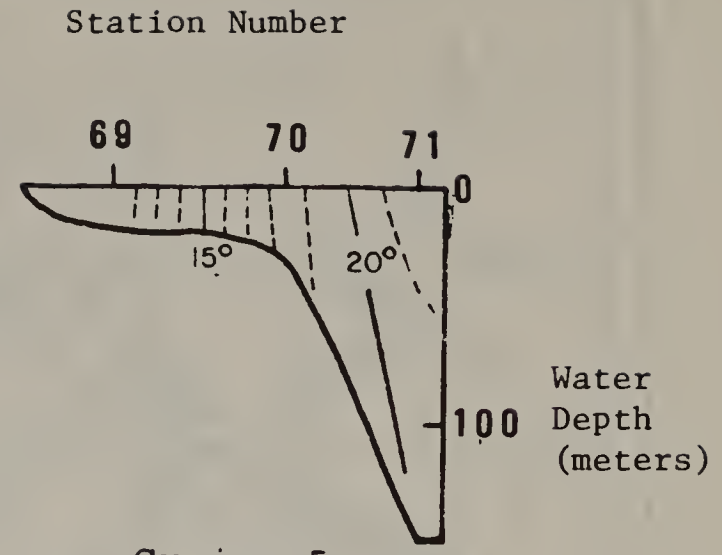
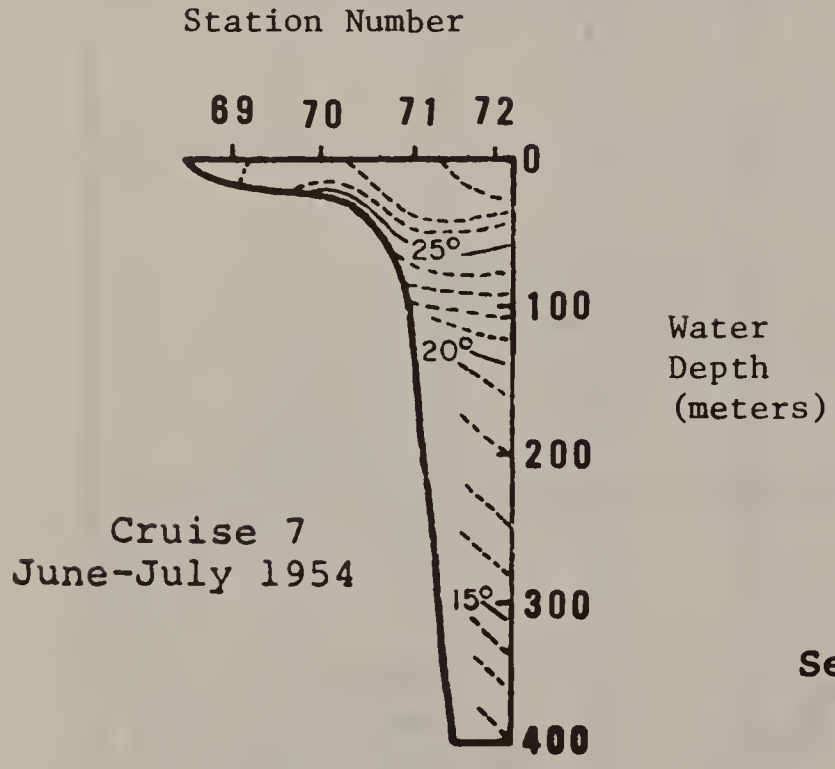


FIGURE B-11 STATIONS OF T.N. GILL CRUISES FOR FIGURES B-12 THROUGH B-17 (VIMS,1974).







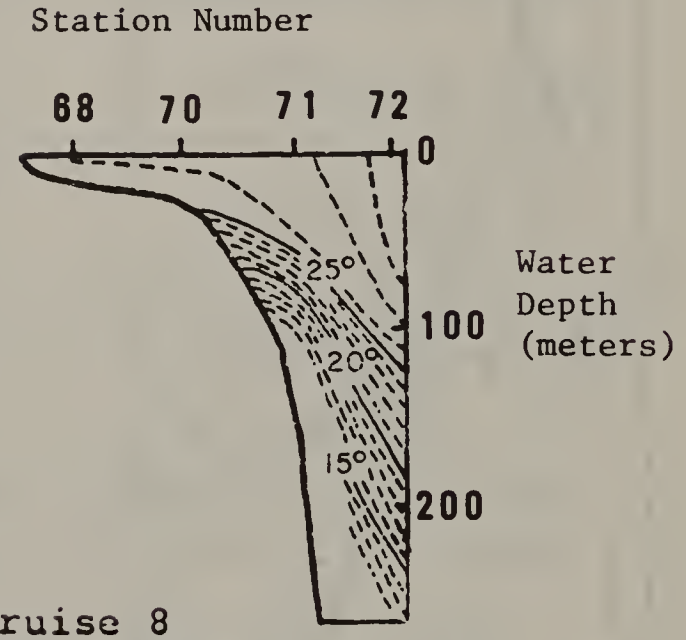


Figure B-12 Seasonal vertical temperature cross-sections (C^{o}), Cape Lookout, N.C. Station Number vs. Depth (meters), see Figure B-11 for station locations. T.N. Gill Cruises (VIMS, 1974).

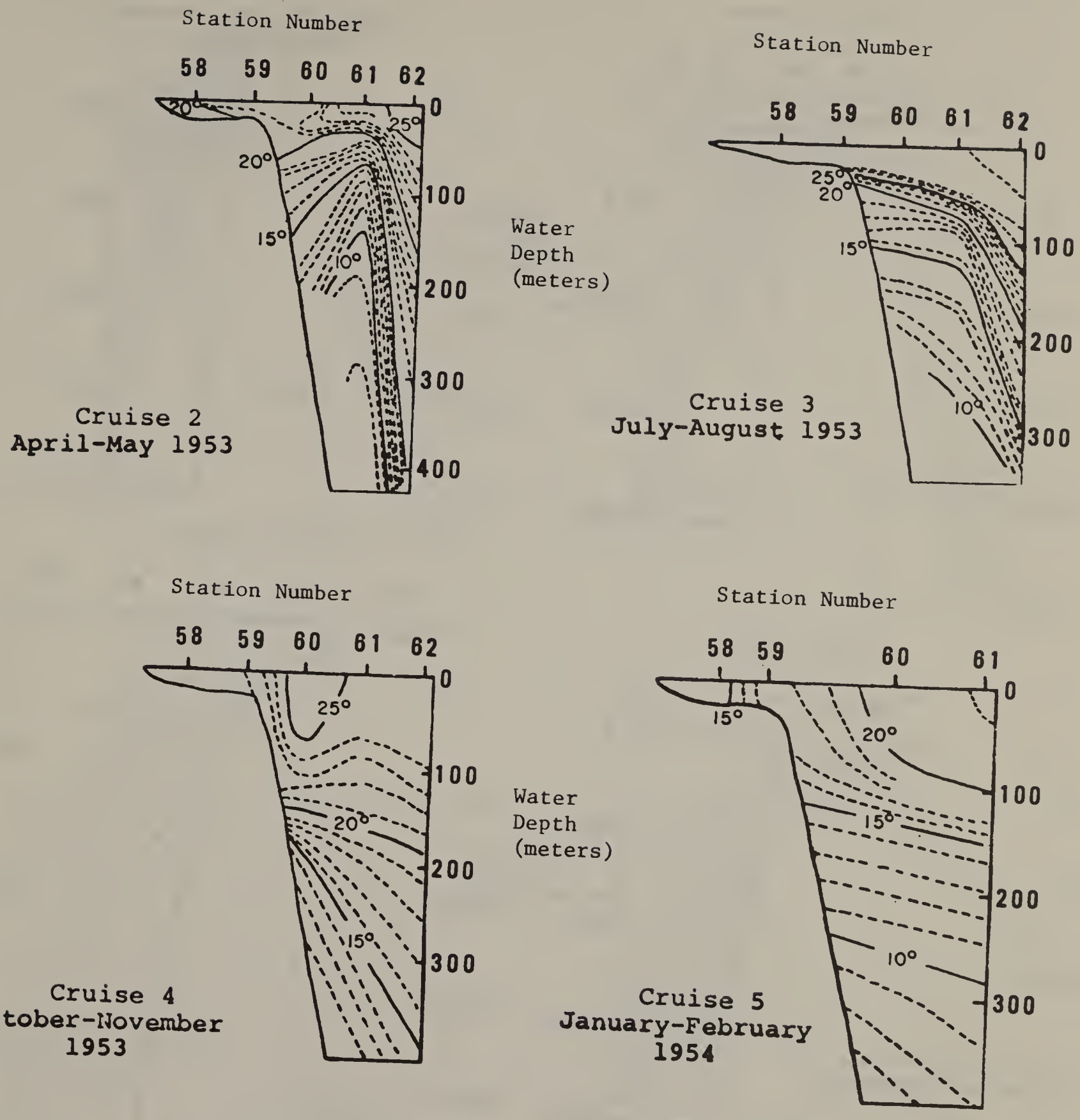
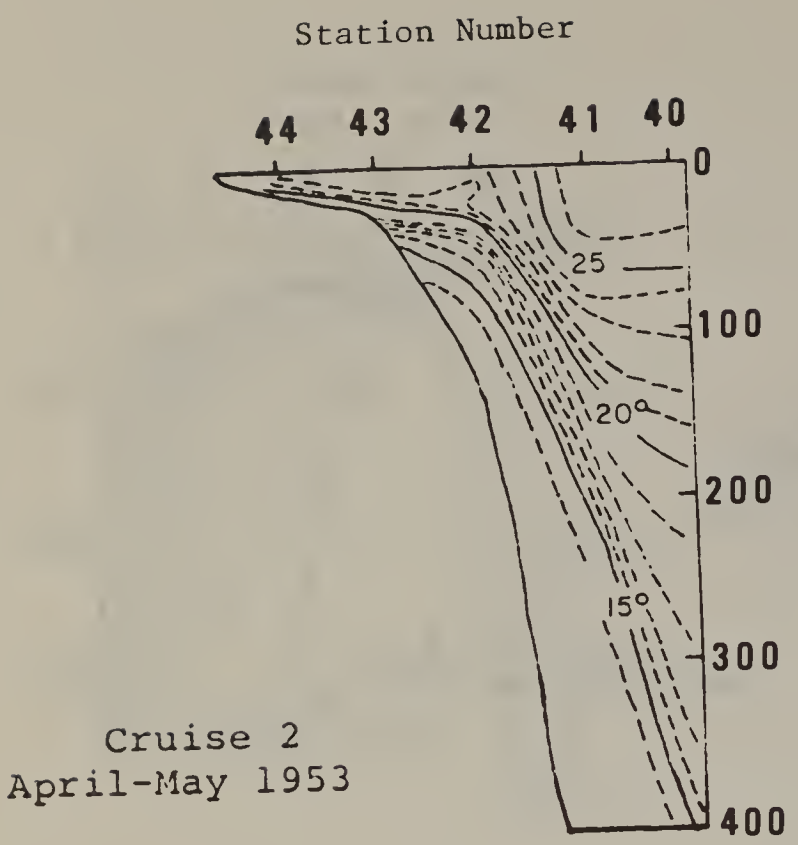
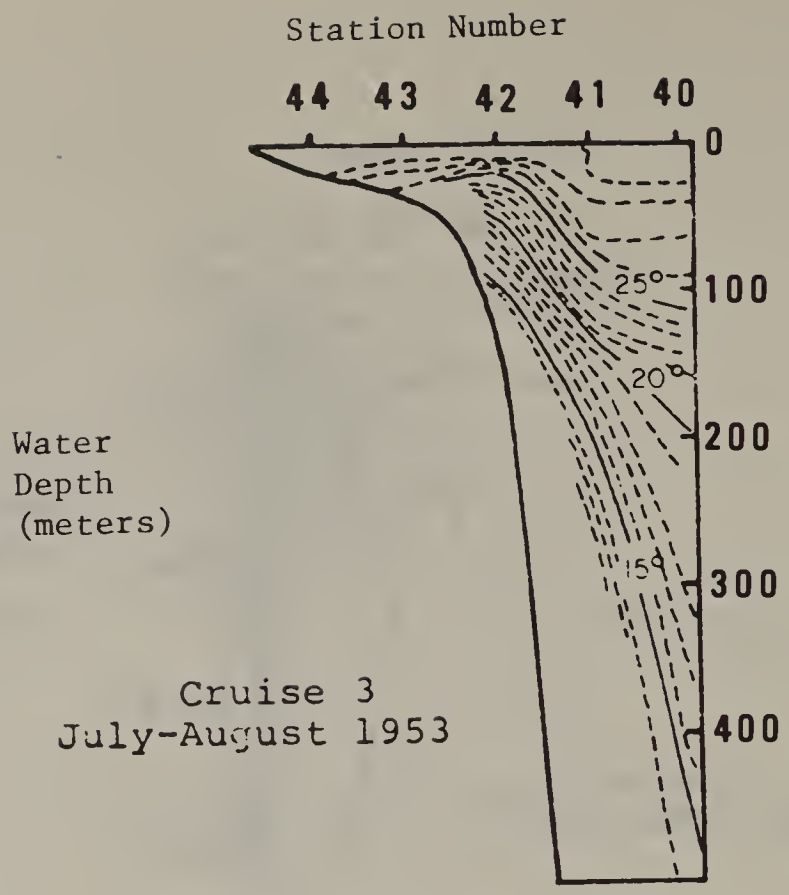
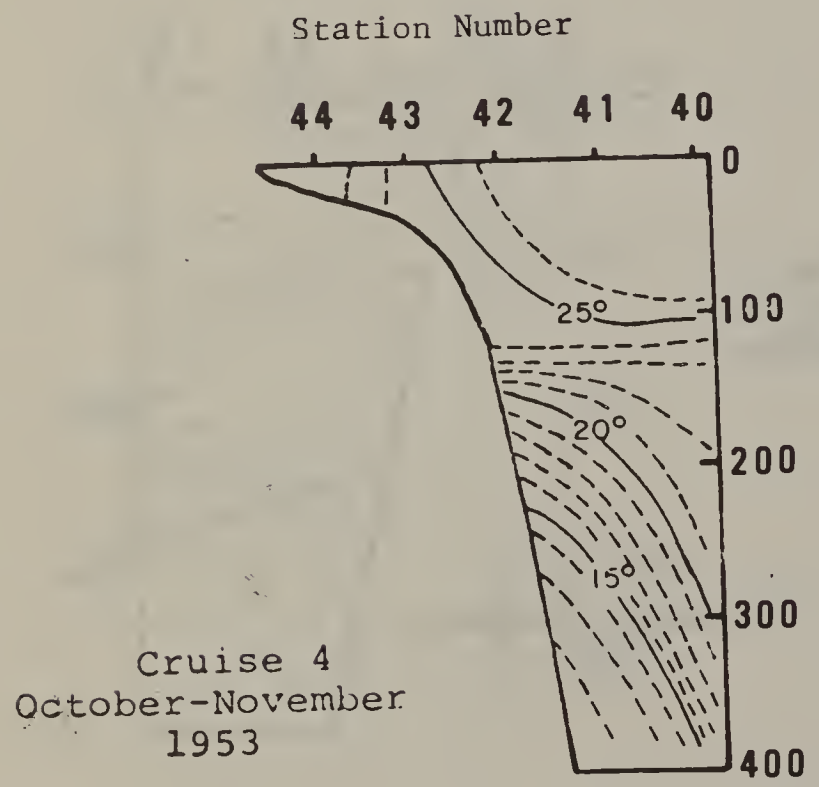


Figure B-13 Seasonal vertical temperature cross-sections (C^{o}), Cape Fear, N.C. Station Number vs. Depth (meters), see Figure B-11 for station locations. T.N. Gill Cruises (VIMS, 1974).







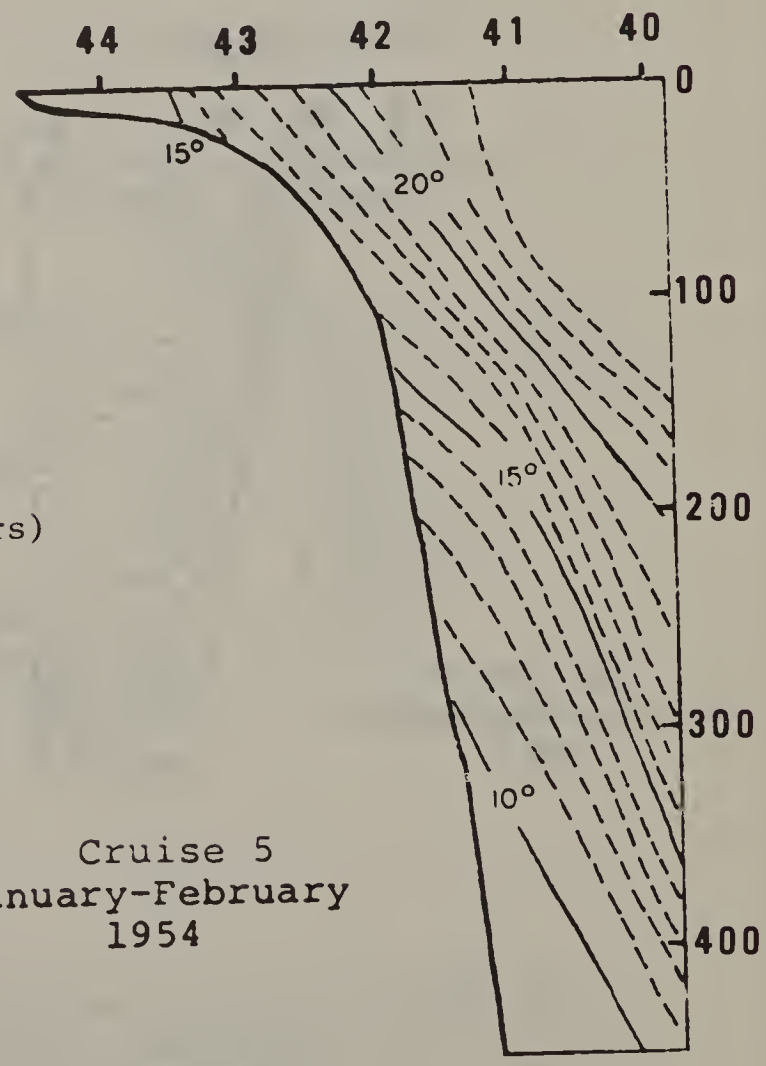
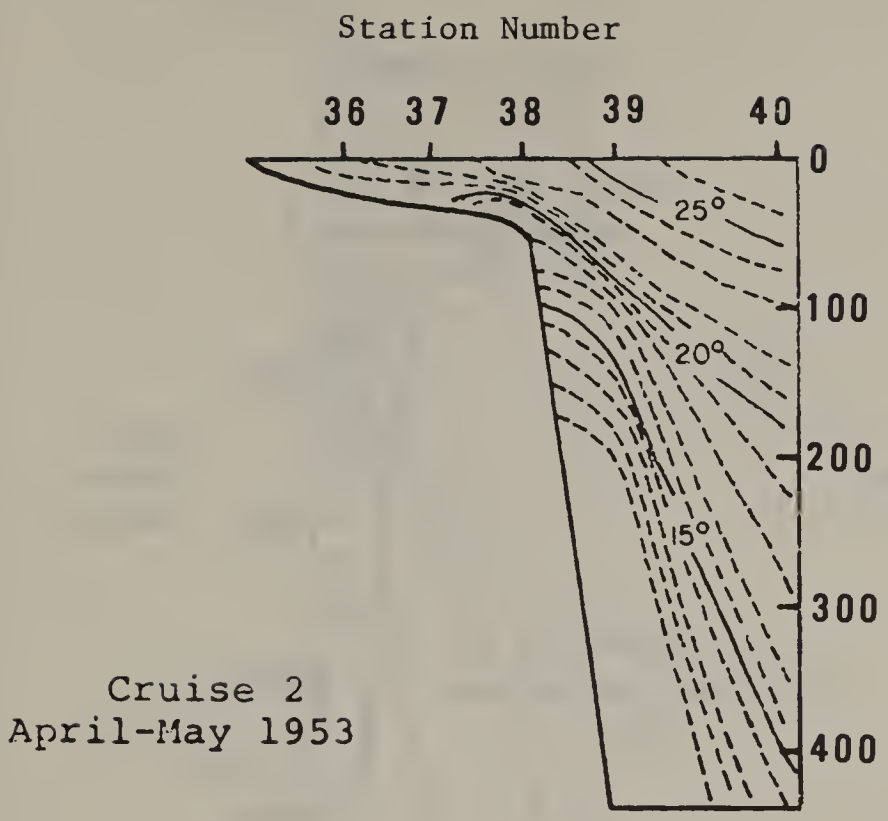
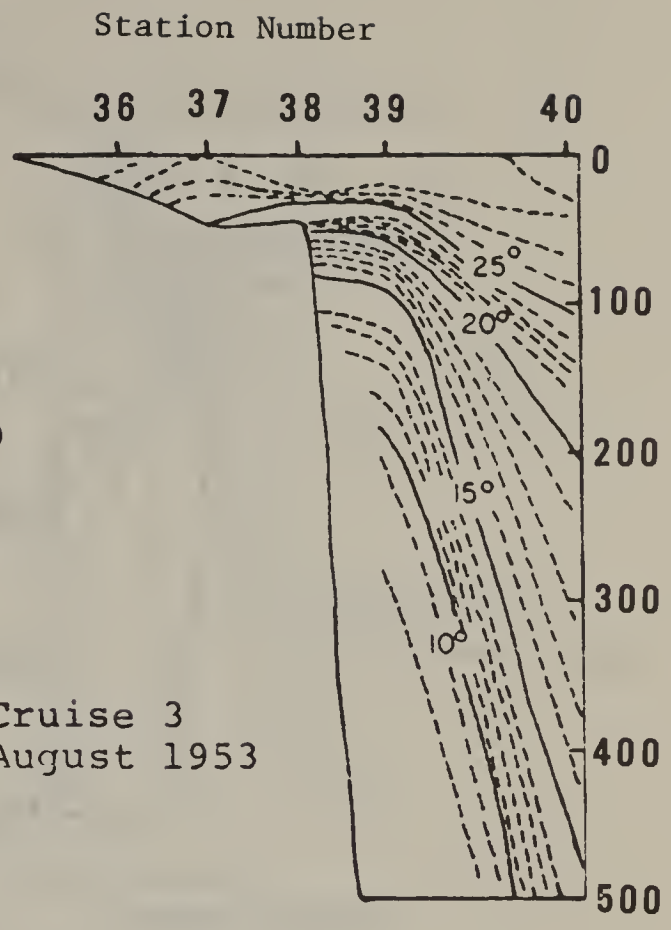


Figure B-14 Seasonal vertical temperature cross-sections, (C^{o}), Charleston S.C., Station Number vs. Depth (meters), see Figure B-11 for station locations. T.N. Gill Cruises, (VIMS, 1974).

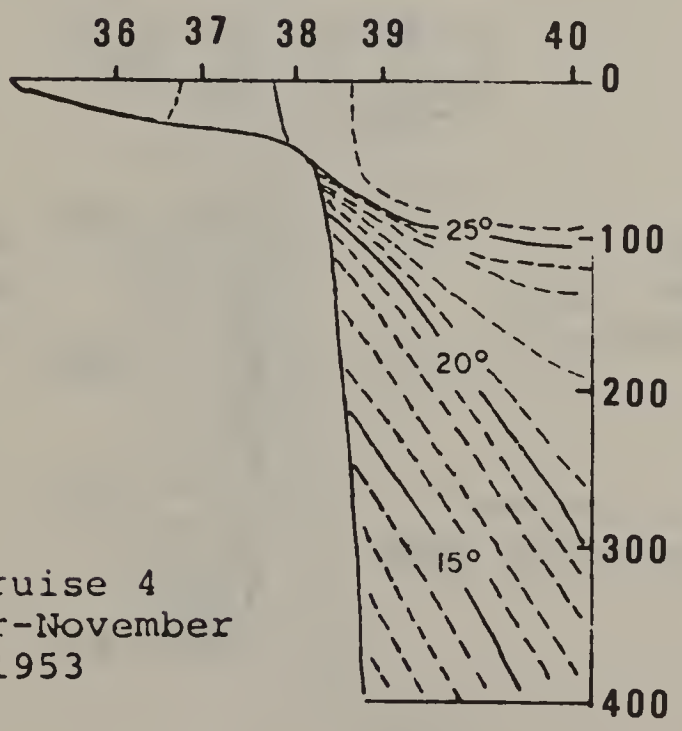


Cruise 2
April-May 1953

Water
Depth
(meters)

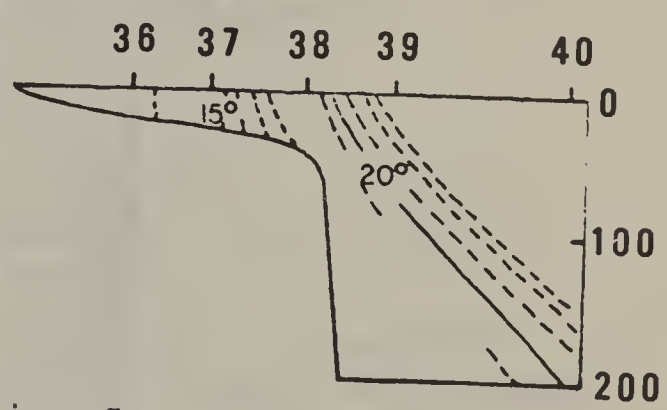


Cruise 3
July-August 1953



Cruise 4
October-November
1953

Water
Depth
(meters)



Cruise 5
January-February
1954

Figure B-15 Seasonal vertical temperature cross-sections, (C^{o}), Savannah, Ga. Station Number vs. Depth (meters), see Figure B-11 for station locations, T.N. Gill Cruises (VIMS, 1974).

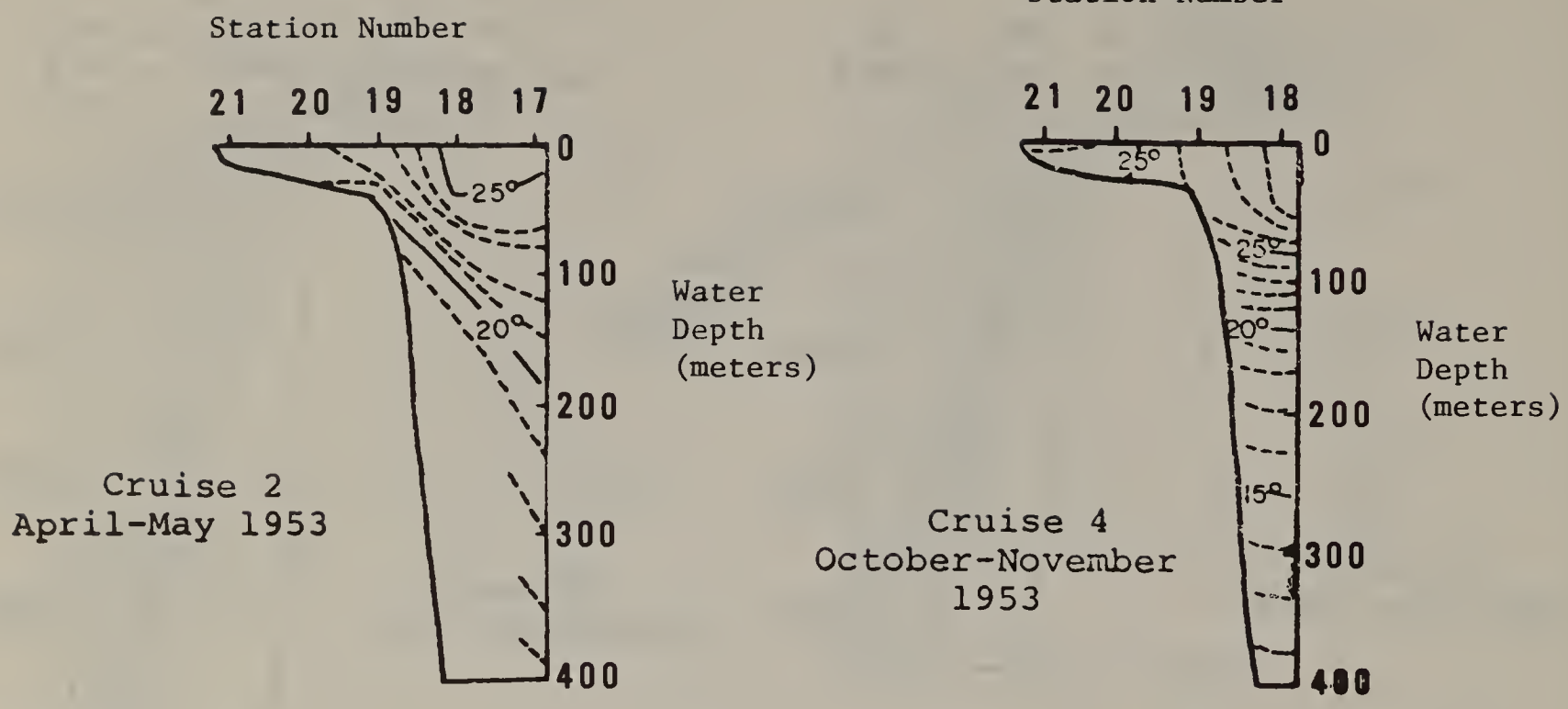
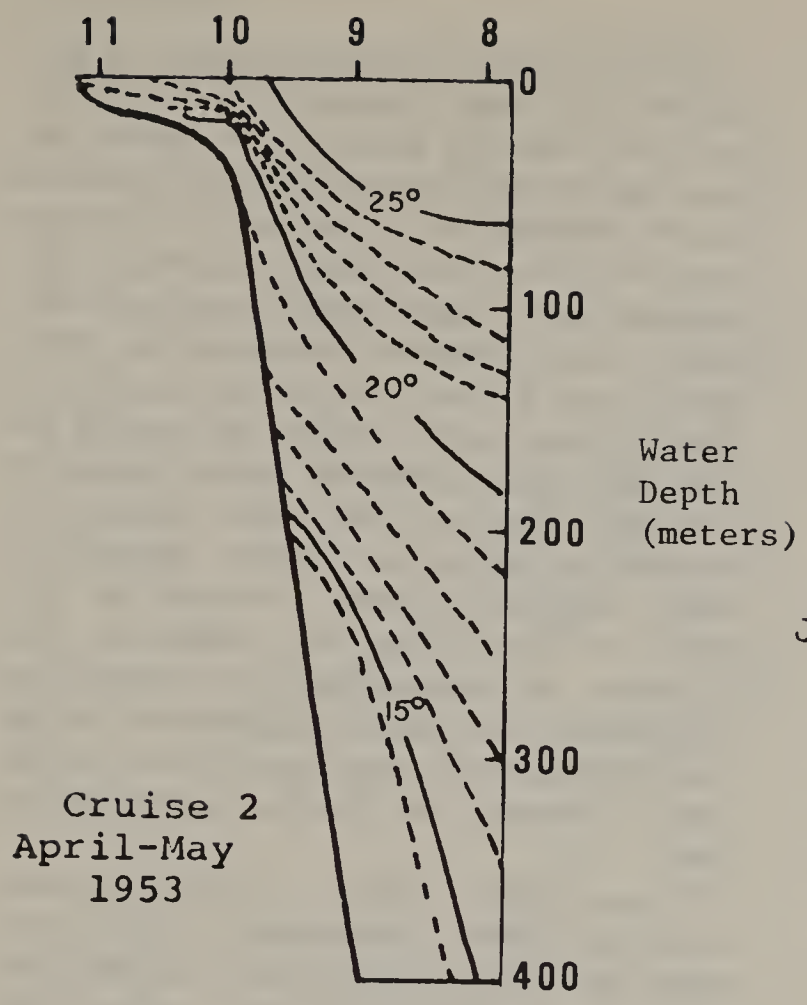
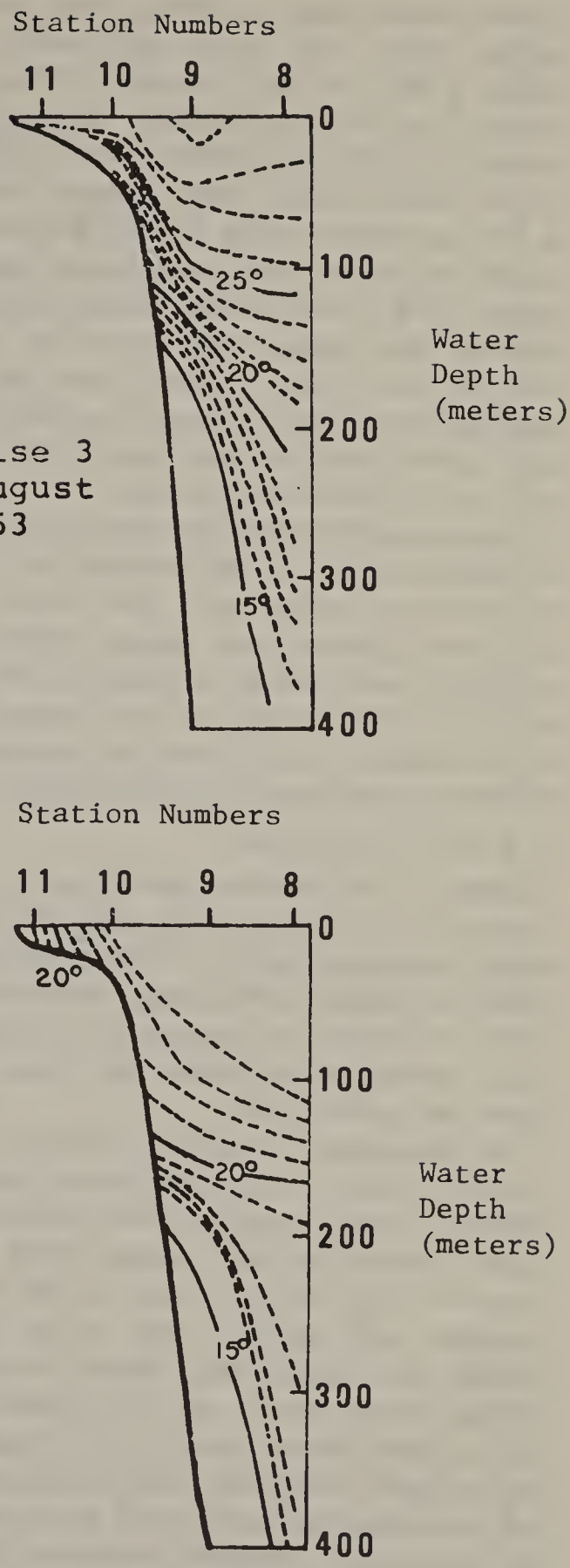


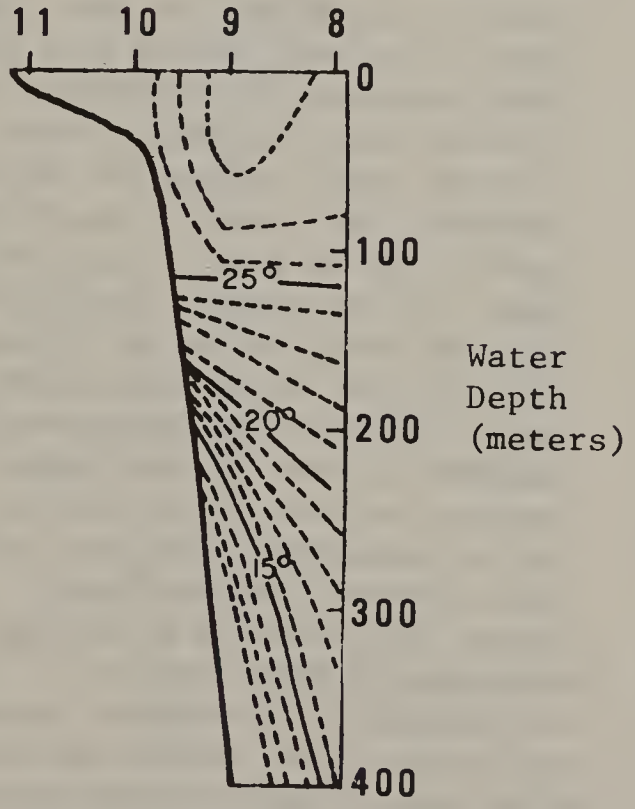
Figure B-16 Seasonal vertical temperature cross-sections (C^{o}), Matanzas Inlet, Fl. Station Number vs. Depth (meters), see Figure B-11 for station locations, T.N. Gill Cruises, (VIMS, 1974).



Cruise 2
April-May
1953



Cruise 3
July-August
1953



Cruise 4
October-November 1953

Cruise 5
January-February 1954

Figure B-17 Seasonal vertical temperature cross-sections (C^{o}), Cape Canaveral, Fl. Station Number vs. Depth (meters), see Figyre B-11 for station locations, T.N. Gill Cruises (VIMS, 1974).

masses; North Atlantic Central Water (NACW), mixing water, shelf water and coastal water (Figure B-18). The North Atlantic Central Water exhibits large seasonal variation in temperature above 200 m (656 ft.) (Section II.B.2). Temperature of NACW remains fairly constant below 200 m. Mixing water is similar to NACW except during fall and winter when temperatures range 5°C lower. Shelf water exhibits more temperature variation than mixing water and has a salinity limit of 34.5-36 pppt. Coastal water has large seasonal variation of temperature and salinity and show lower values of both characteristics than shelf water except during summer.

Bumpus and Pierce (1955) showed coastal water of North Carolina to be composed of Carolina coastal water (warm, saline Gulf Stream water and river effluents) and Virginia coastal water (cold shelf water and river effluents). Stefansson et al. (1971) found that the Gulf Stream is the characteristic water mass over the outer shelf and beyond the shelf break off North Carolina.

B. SURFACE CIRCULATION

Much of the following information on surface circulation in the area of the proposed sale was taken from interpretation of drift bottle data obtained by Bumpus (1973) during the period 1960-1970. The bottles are ballasted to be affected by water movement just below the water surface rather than surface wind.

The data suggest a northerly component of drift from off Georgia to Cape Hatteras in January and February, with a southerly flow along the Florida coast to where the shelf narrows south of Cape Canaveral (Figures B-19 and B-20). A weak southerly drift appears close to the shore in Raleigh and Onslow Bays during February, expanding during March with the addition of Virginia Coastal Water (Figure B-21). During April the southerly drifts near shore are discontinuous and as northerly currents prevail over most of the shelf from Cape Canaveral northward (Figure B-22). By May, a strong southerly current segmented by indrafts from the Florida Current exists southward from Frying Pan Shoals. The shelf currents in June are northerly and nearshore currents are southerly (Figure B-24). Virginia coastal water in addition to Gulf Stream water flows past Cape Hatteras into Raleigh Bay.

According to Bumpus:

> "With the recovery rate still modest in July, the drift off North Carolina is now northeasterly. The Virginian coastal water indraft has been pinched off. The drift off Cape Canaveral is still northerly, but a southerly drift begins over the mid-part of the shelf off Georgia. This southerly drift expands during August and continues during September, involving the whole shelf from Frying Pan Shoals southward. Florida Current water becomes entrained in the shelf drift, which commonly reaches speeds of 9 nautical miles/day. Off North Carolina the direction of drift is intermittent, northerly at times, southerly on other occasions. By October and continuing into November and December, the southerly drift is restricted to off Georgia and Florida; the remainder of the shelf exhibits a very poor recovery rate, insufficient to determine the direction and velocity of drift.
>
> It would appear that two conflicting systems are at play here, a geostrophic current interrupted by invasions of the Florida Current. The geostrophic current tends to flow southerly and does so successfully in May, during late summer, and early autumn from Frying Pan Shoals southward. It is interrupted frequently by invasions of the Florida Current riding up over the shelf carrying the surface water northward. On those occasions when the recovery rate is poor in the South Atlantic Bight, one can generally assume the surface water has been forced out by a meander of the Florida Current, and the drift bottles have been carried north past Cape Hatteras and out of the immediate system. It would appear that the meanders are more frequent and more successful in accomplishing this total exchange of water north of Frying Pan Shoals."

Figures B-25 through B-30 illustrate the above interpretation by Bumpus (1973).

In conclusion, the southerly coastal current found north of Cape Hatteras becomes transient on the shelf off North Carolina, South Carolina and Georgia. Major factors influencing circulation in the proposed sale area are density gradients caused by temperature and salinity differences, the nearby Gulf Stream, and prevailing winds. The Gulf Stream exerts a northward frictional drag on those waters lying on the continental shelf. Both Gray and Cerame-Vivas (1963) and Bumpus and Lauzier (1965) indicate that there is

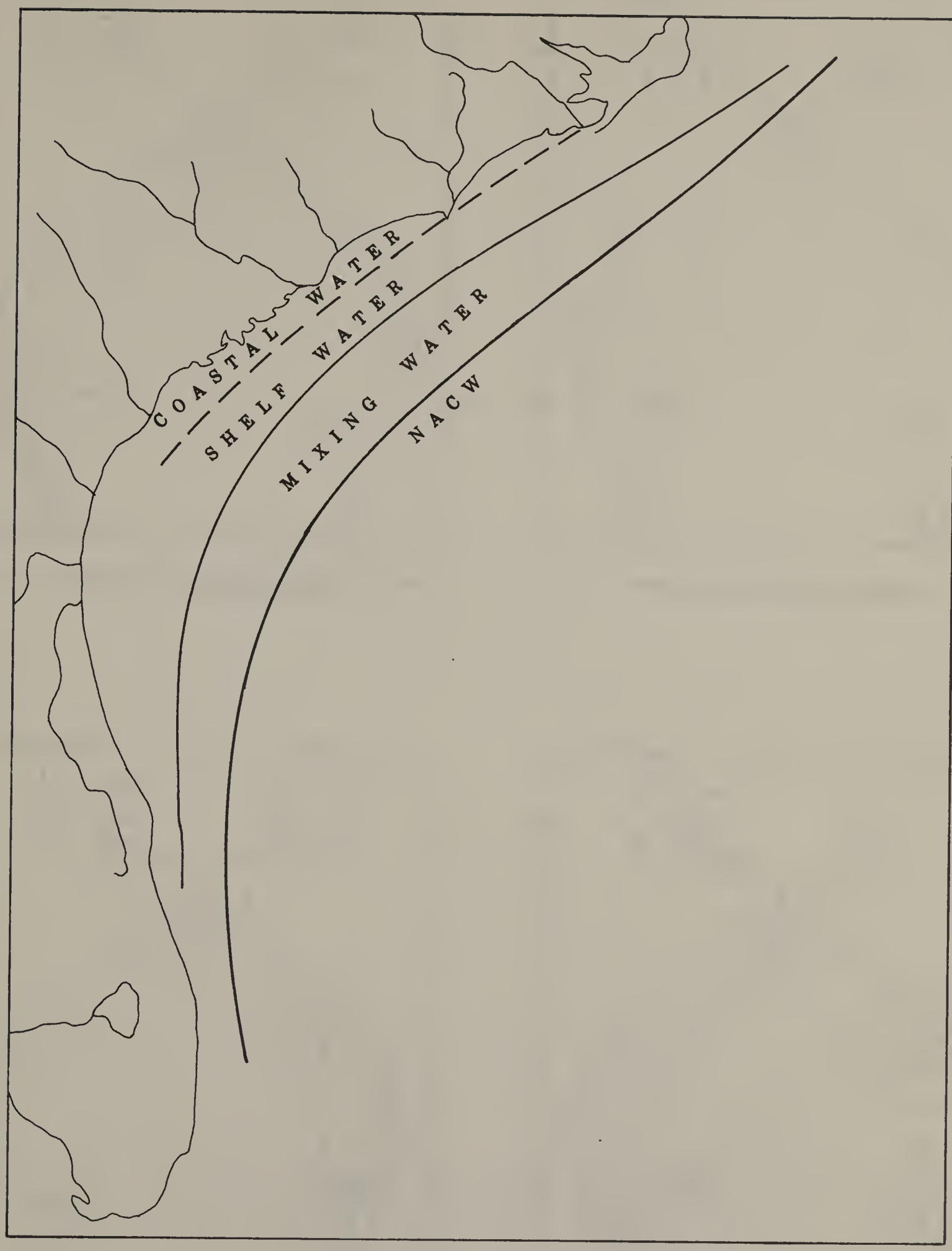


Figure B-18-Location of water masses on the South Atlantic Bight according to Kuroda and Marland (1973).

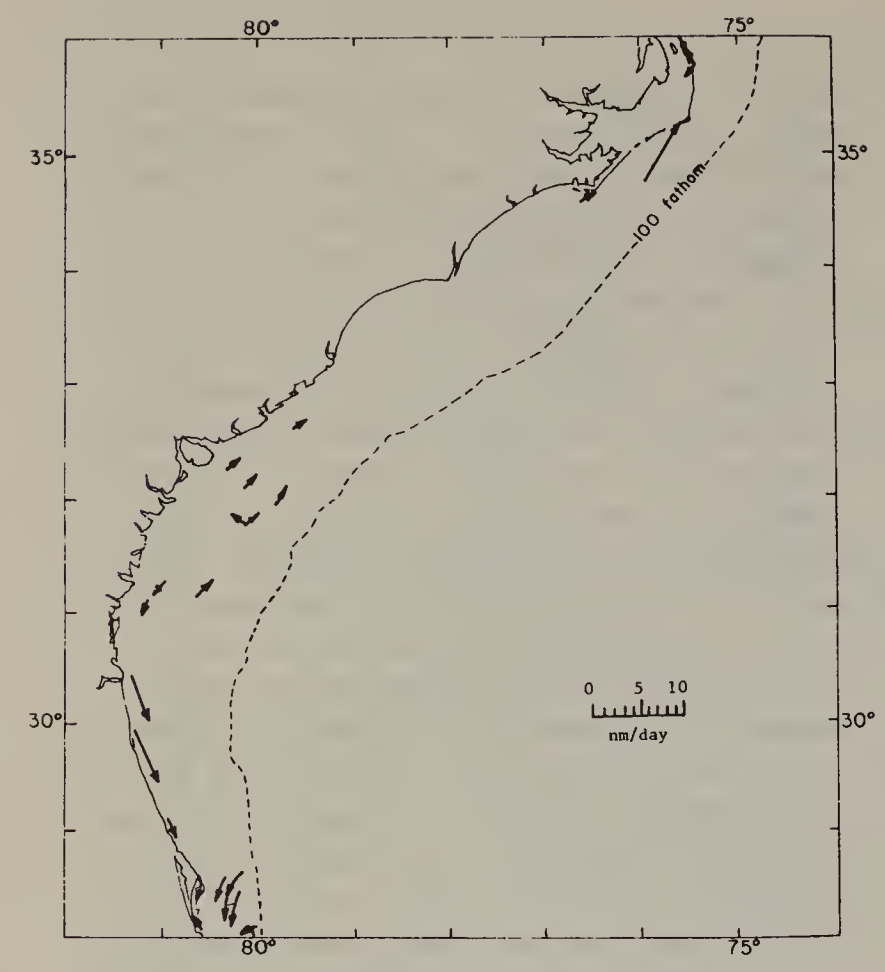


Figure B-19. Inferred surface drift, Jan. 1960-1970 (after Bumpus, 1973).

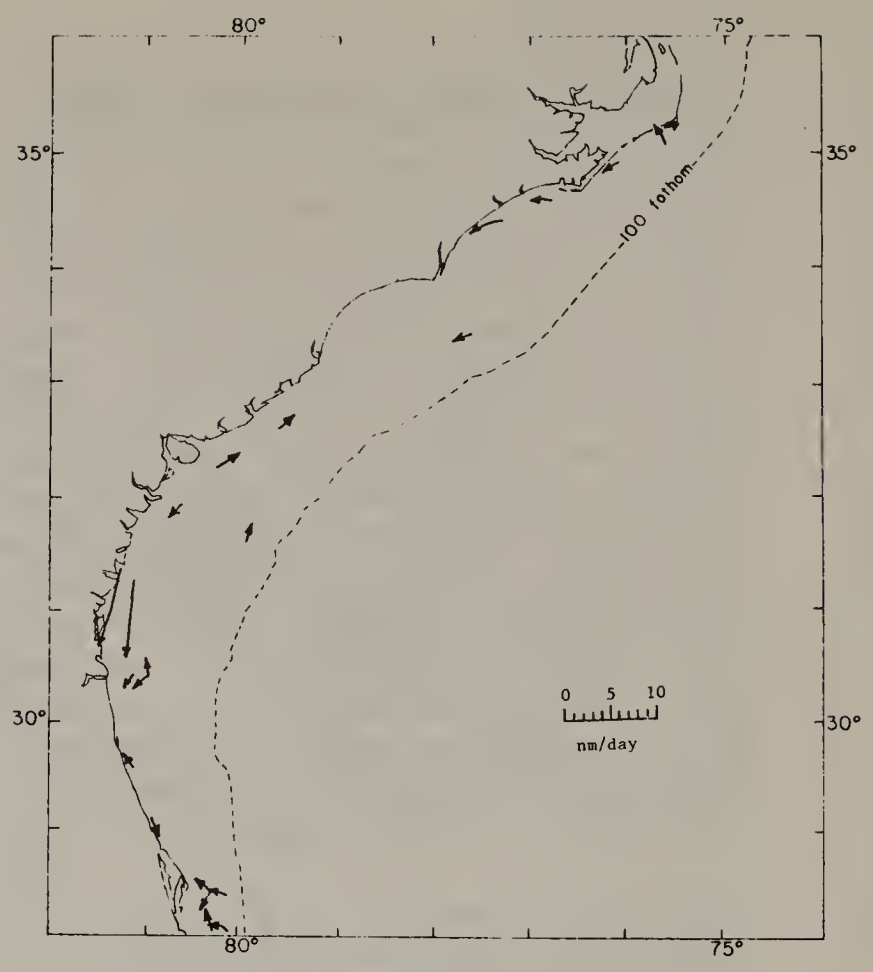


Figure B-20. Inferred surface drift, Feb. 1960-1970 (after Bumpus, 1973).

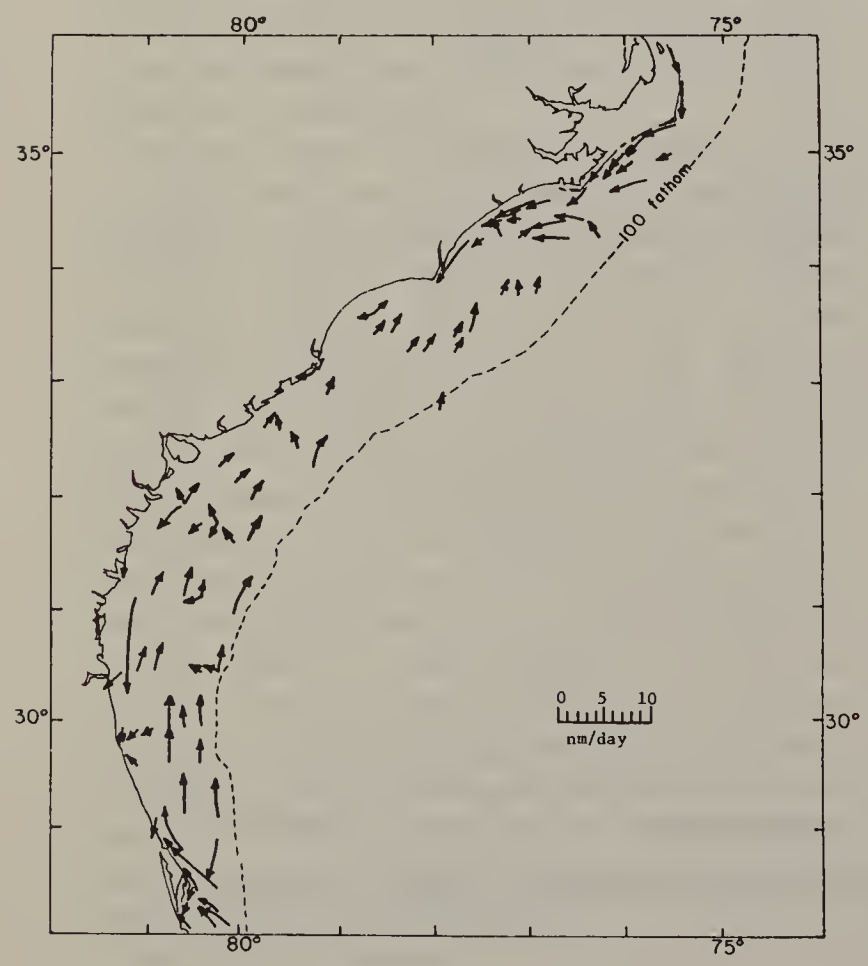


Figure B-21. Inferred surface drift, Mar. 1960-1970 (after Bumpus, 1973).

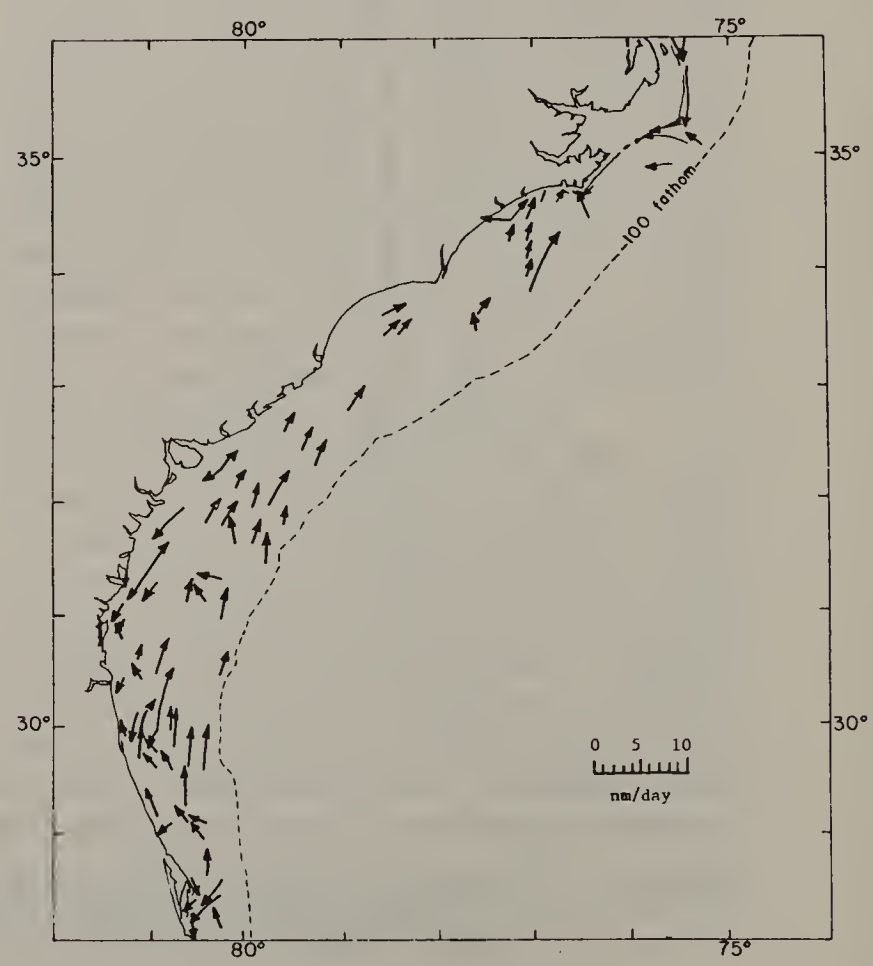


Figure B-22. Inferred surface drift, Apr. 1960-1970 (after Bumpus, 1973).

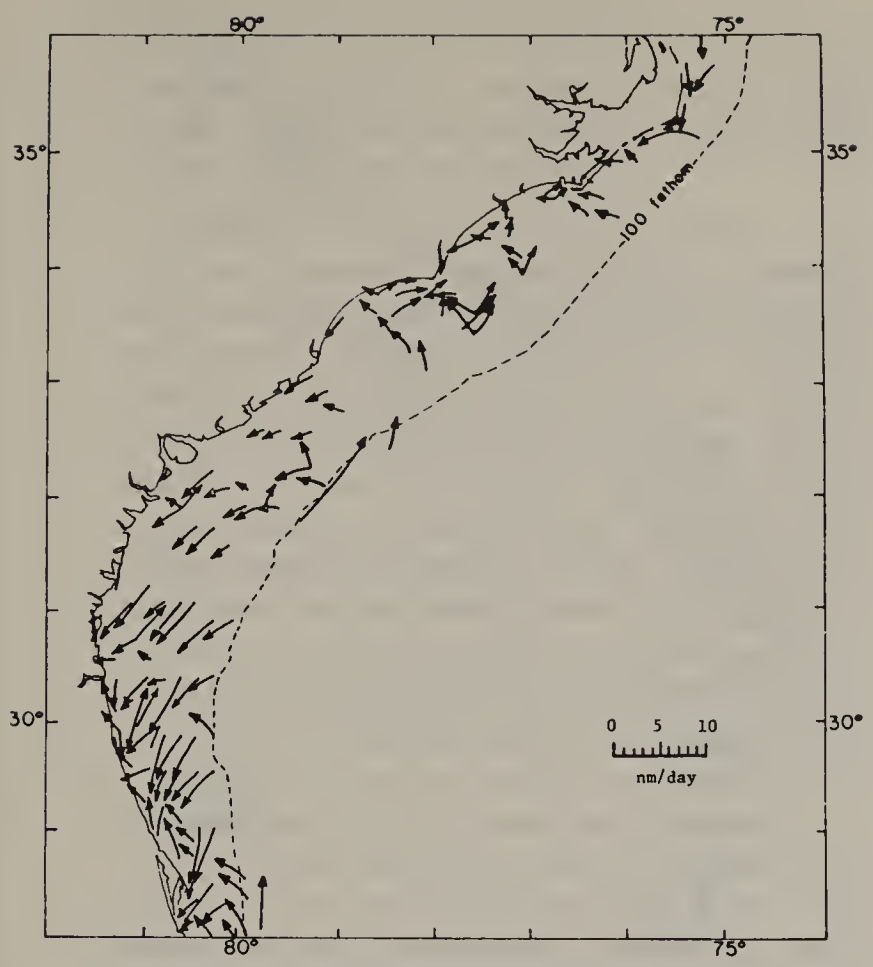


Figure B-23. Inferred surface drift, May 1960-1970 (after Bumpus, 1973).

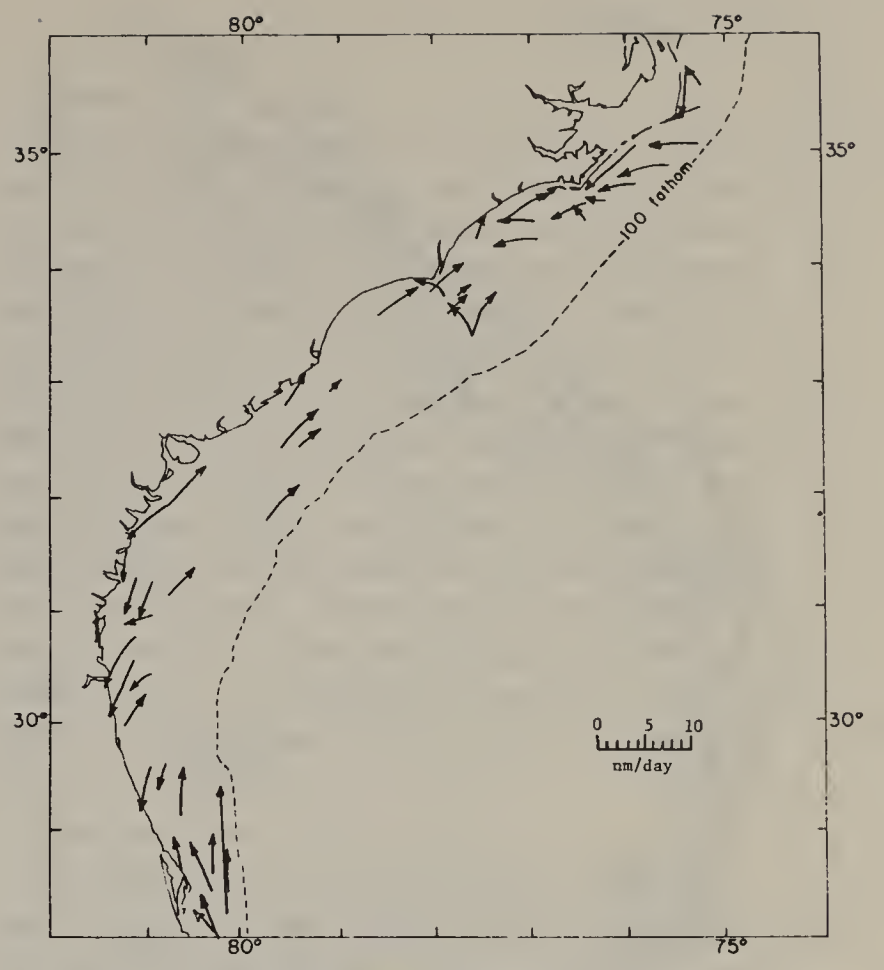


Figure B-24. Inferred surface drift, Jun. 1960-1970 (after Bumpus, 1973).

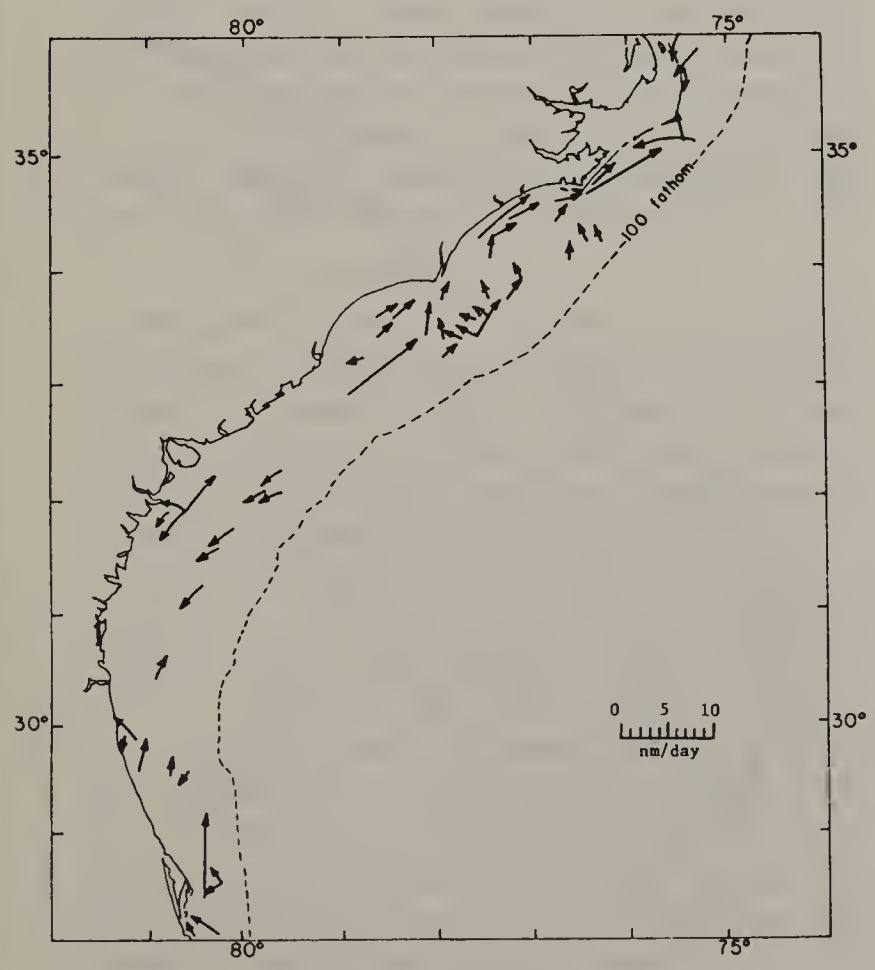


Figure B-25. Inferred surface drift, Jul. 1960-1970 (after Bumpus, 1973).

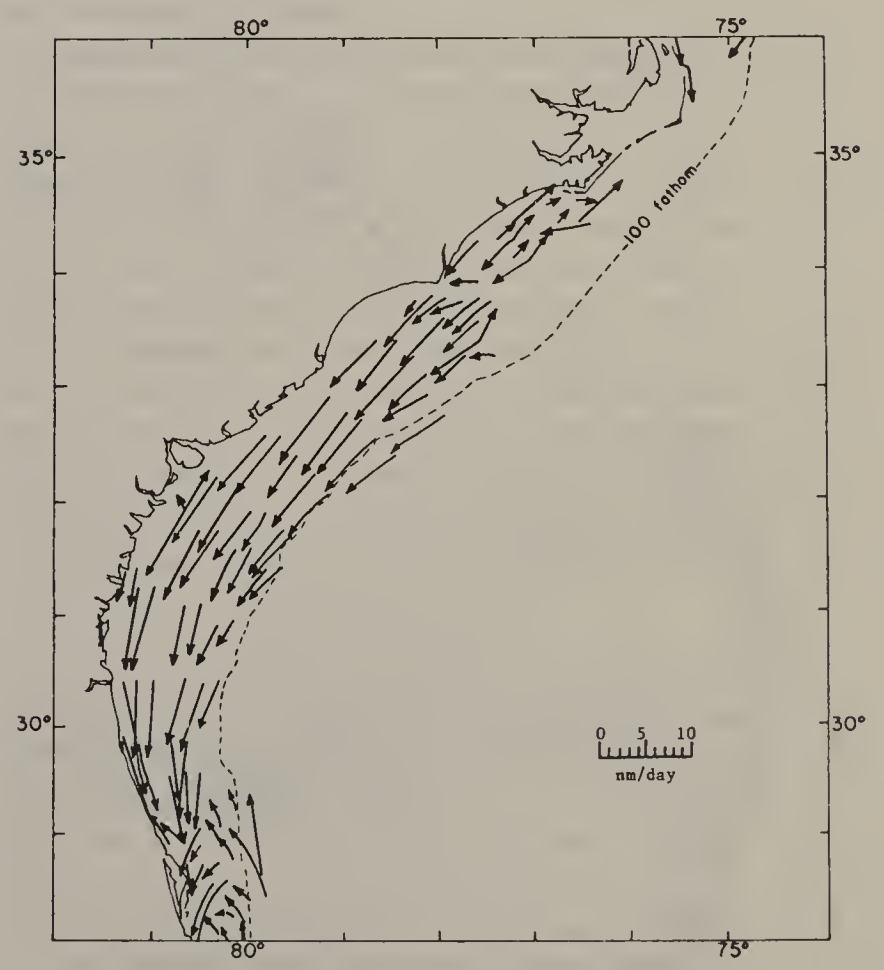


Figure B-26 Inferred surface drift, Aug. 1960-1970 (after Bumpus, 1973).



Figure B-27. Inferred surface drift, Sept. 1960-1970 (after Bumpus, 1973).

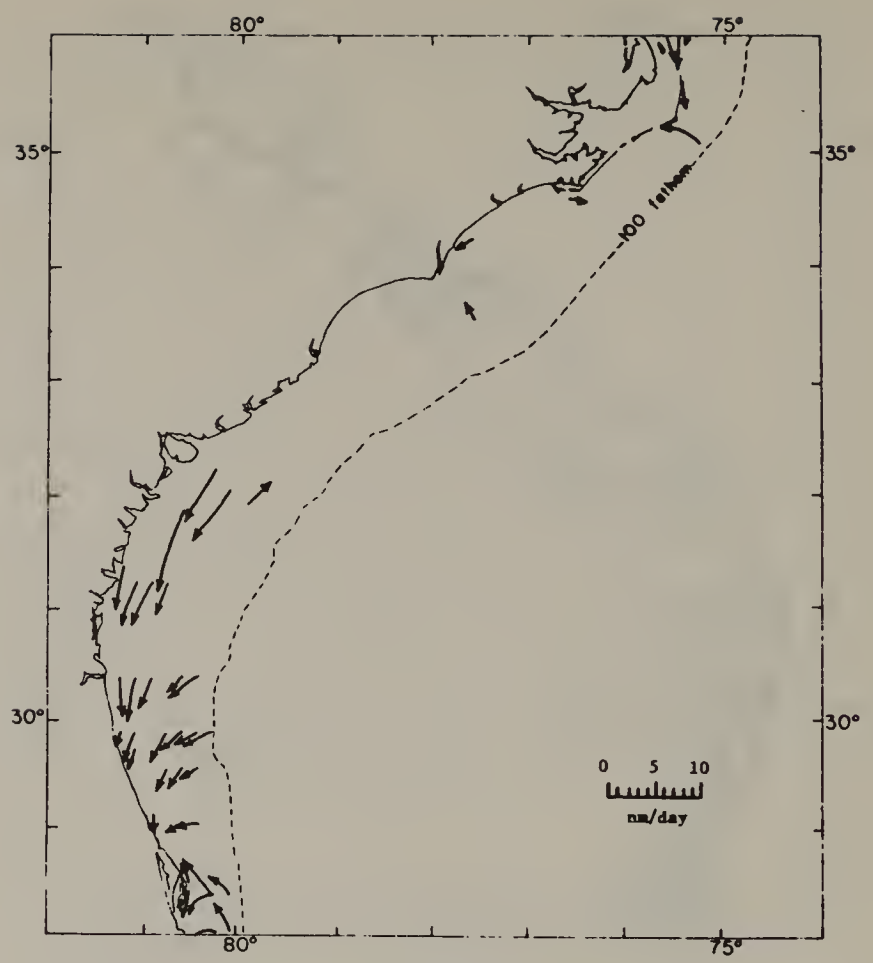


Figure B-28. Inferred surface drift, Oct. 1960-1970 (after Bumpus, 1973).

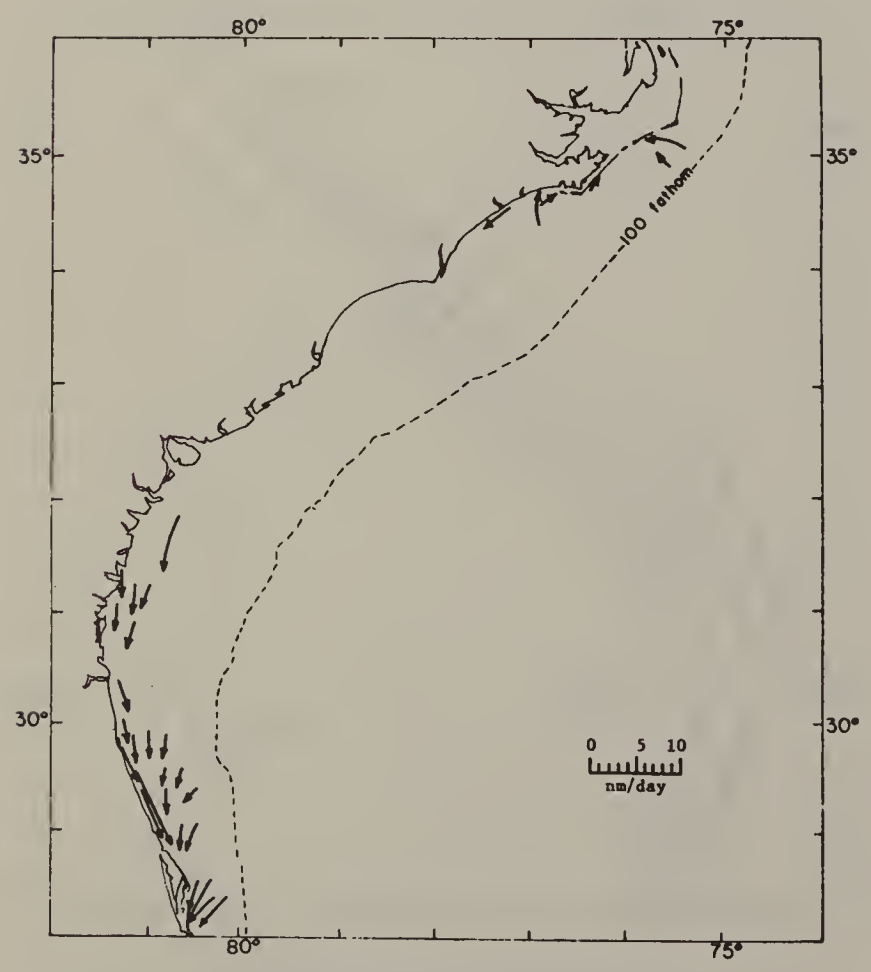


Figure B-29. Inferred surface drift, Nov. 1960-1970 (after Bumpus, 1973).

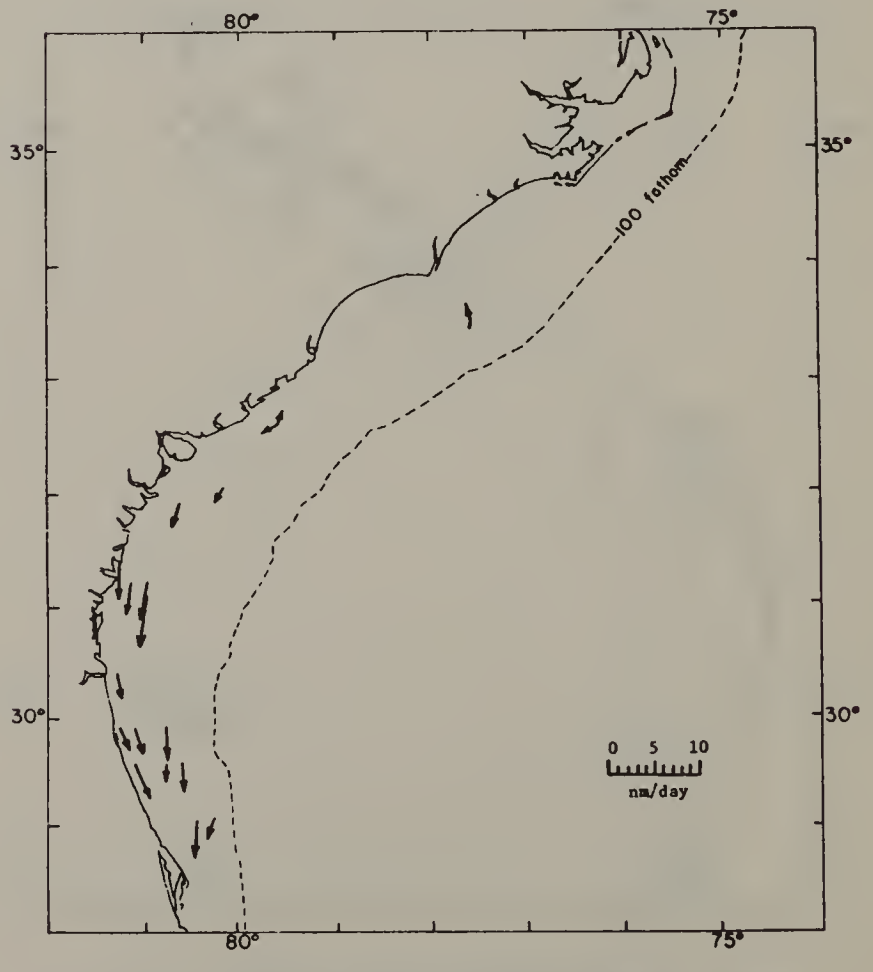


Figure B-30. Inferred surface drift, Dec. 1960-1970 (after Bumpus, 1973).

a tendency towards a southerly flowing coastal current inshore of the predominant northeasterly flowing current much of the time.

c. SUBSURFACE AND BOTTOM CIRCULATION

Bottom current data presented by Bumpus (1973), obtained form sea bed drifters indicated a convergence towards capes, i.e. Hatteras, Lookout, Fear and Canaveral. Off the Carolina Bays the bottom drift is northerly (less than 2.3 cm/sec.) on the outer shelf with a tendency toward shore or southerly near the coast. Off South Carolina and Georgia bottom drift measurements show no consistent pattern. It is speculated that these currents are directly influenced by indrafts from the Gulf Stream with periods of about two weeks. Off Florida that drift is northerly with a confused, sometimes north, sometimes south, drift between Cape Canaveral and Jacksonville.

Water on the continental shelf of the Southeast Georgia Embayment is renewed from the Gulf Stream by two mechanisms. In summer, when shelf water becomes warmed and less dense water intrudes along the bottom. This movement has been inferred from oxygen anomalies and nutrient distributions (Stefansson et al., 1971). As water moves up the shelf and mixes upward, nearshore surface water is flushed offshore. During winter, cooler nearshore water cascades down the shelf allowing Gulf Stream water to intrude on the surface as mentioned in Section B.2. (Stefansson et al., 1971). Upwelling of cool water in July and August along the central Florida coast has also been reported by Taylor and Stewart (1959).

d. THE GULF STREAM

The Gulf Stream is one of the major currents that form a clockwise gyral in the North Atlantic Ocean (Jacobson, 1974). It flows northward through the Straits of Florida along the continental slope north to Cape Hatteras. Total transport of water through the Straits of Florida is approximately 32 x 10^6 m^3/sec and increases to approximately 63 x 10^6 m^3/sec by the time the Gulf Stream reaches Cape Hatteras. Figure B-31 depicts the velocity of the Gulf Stream at four locations within the area of interest. Figures B-32 to B-34 illustrate the current speed variation with depth off Cape Canaveral, Jacksonville, and Cape Fear. Measurements taken of bottom current on the Blake Plateau (Pratt, 1963) during June and July 1961 show speeds averaging 25 cm/sec.

4. Waves

Wind waves are formed by a transfer of energy from turbulent air flowing over water. The wind velocity, the distance over which the wind blows (fetch), and the length of time that the wind blows (duration) all have a direct effect upon wave propagation and size. In general, any increase in these three factors will result in larger waves. Where waves are irregular and actively being generated by wind is called sea. Sea waves that are no longer under wind influence will become more uniform as the faster waves move through the slower ones. These well-sorted, uniform waves, far from the generating influence are called swell. It is possible for sea and swell to occur in the same area resulting in a "confused" sea.

a. THE OFFSHORE WAVE CLIMATE

The offshore wave climate for the southeast Atlantic coast of the United States, generally, reflects the predominant wind conditions that prevail during a particular season. The wave conditions throughout the area of interest are more severe during the fall and winter when waves are larger and move in from the north and west (Table B-1). The majority of waves along this coast during spring and summer are small and from the south and east.

Figures B-35 thru B-38 have been prepared by VIMS (1974) from U. S. Naval weather service command data. These data were obtained from a comprehensive collection of marine surface weather observations that were taken aboard vessels of varying registry. These data are somewhat biased towards good weather since ships tend to avoid inclement weather whenever possible. The data presented in the roses are visual estimates and are of sea waves only (Jacobson, 1974). Charts of isolines of percent frequency are based on tabulations by two degree squares of data at the National Climatic Center and the U. S. Oceanographic Office prior to 1958.

(1) Area 17—Cape Hatteras (Fig. B-35)

Wave heights in this area are observed to be less than 1.2 m (4 ft.) 58% of the time during the year. Waves were observed to be greater than 3.7 m (12 ft.) for two percent of the year.

(2) Area 19—Charleston (Fig. B-35)

Seas were observed to be less than 1.2 m (4 ft.) 57% and greater than 3.7 m (12 ft.) two percent of the time during the year.

(3) Area 20—Jacksonville (Fig. B-35)

Seas of less than 1.2 m (4 ft.) occur 62% and greater than 3.7 m (12 ft.) less than one percent of the time during the year.

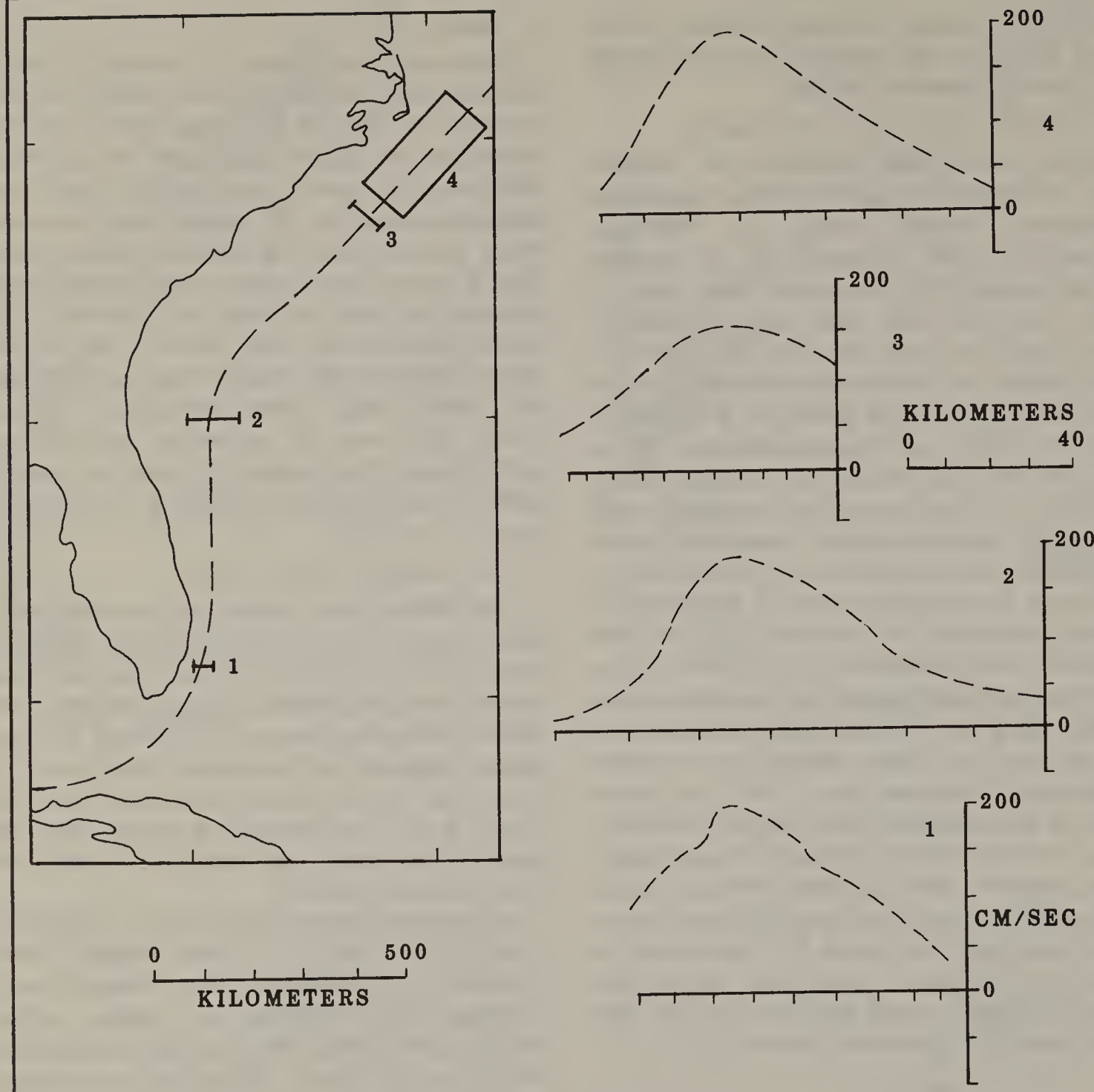


Figure B-31-Observed downstream velocity in cm/sec at four locations along the Gulf Stream (Webster, 1961).

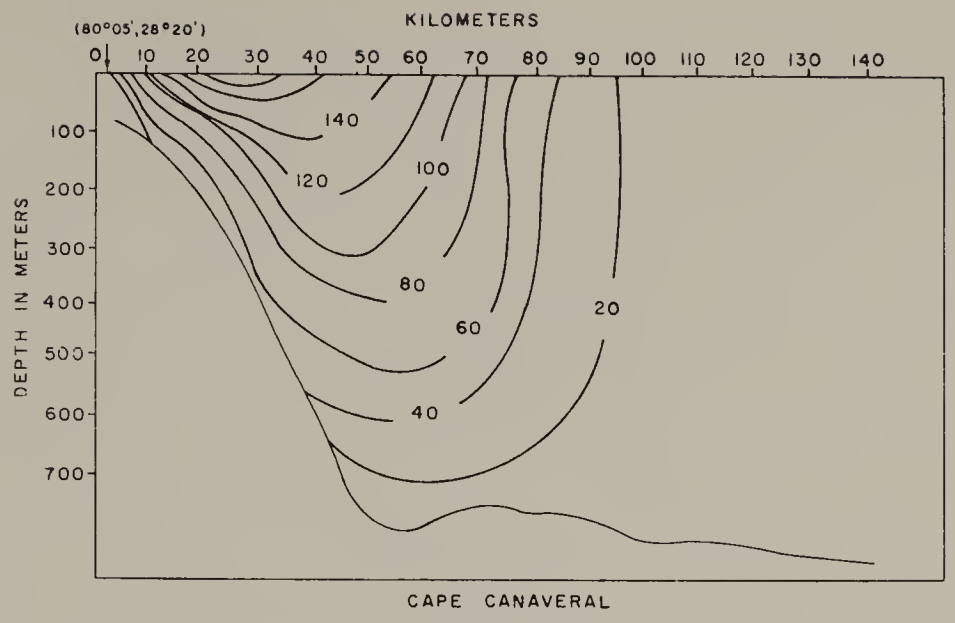


Figure B-32 Downstream velocity of Gulf Stream off Cape Canaveral in cm/sec (Richardson et al. 1969).

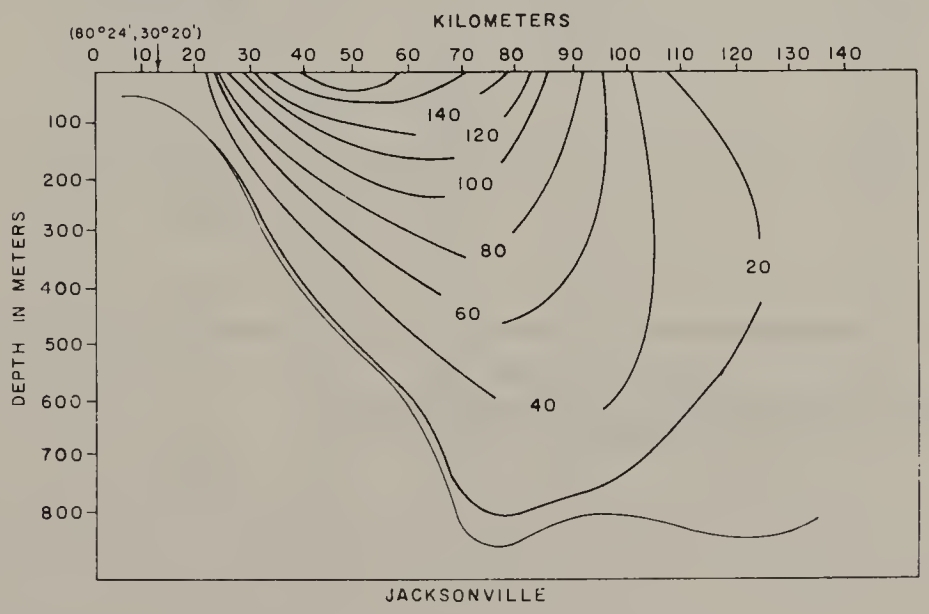


Figure B-33 Downstream velocity of Gulf Stream off Jacksonville in cm/sec (Richardson et al. 1969).

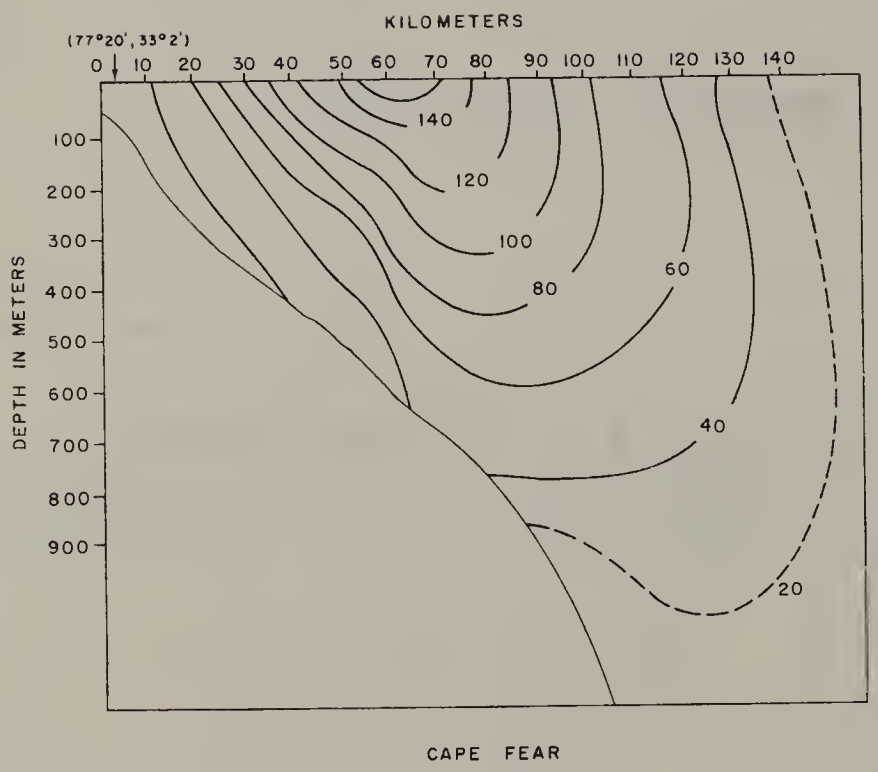


Figure B-34 Downstream velocity of Gulf Stream off Cape Fear in cm/sec (Richardson et al. 1969).

Table B-1

Offshore Wave Climate, Southeastern U.S. Offshore Region

SSMO AREA	Height (meters)	Percent Frequency Feb.	May	Aug.	Nov.	Annual
AREA 17	1.22	40	66	74	52	58
	3.66	5	2	1	2	2.5
AREA 19	1.22	40	66	74	48	57
	3.66	5	2	1	1.5	2.4
AREA 20	1.22	40	76	83	49	52
	3.66	5	1	1	1	2

Source: Helle, 1953.

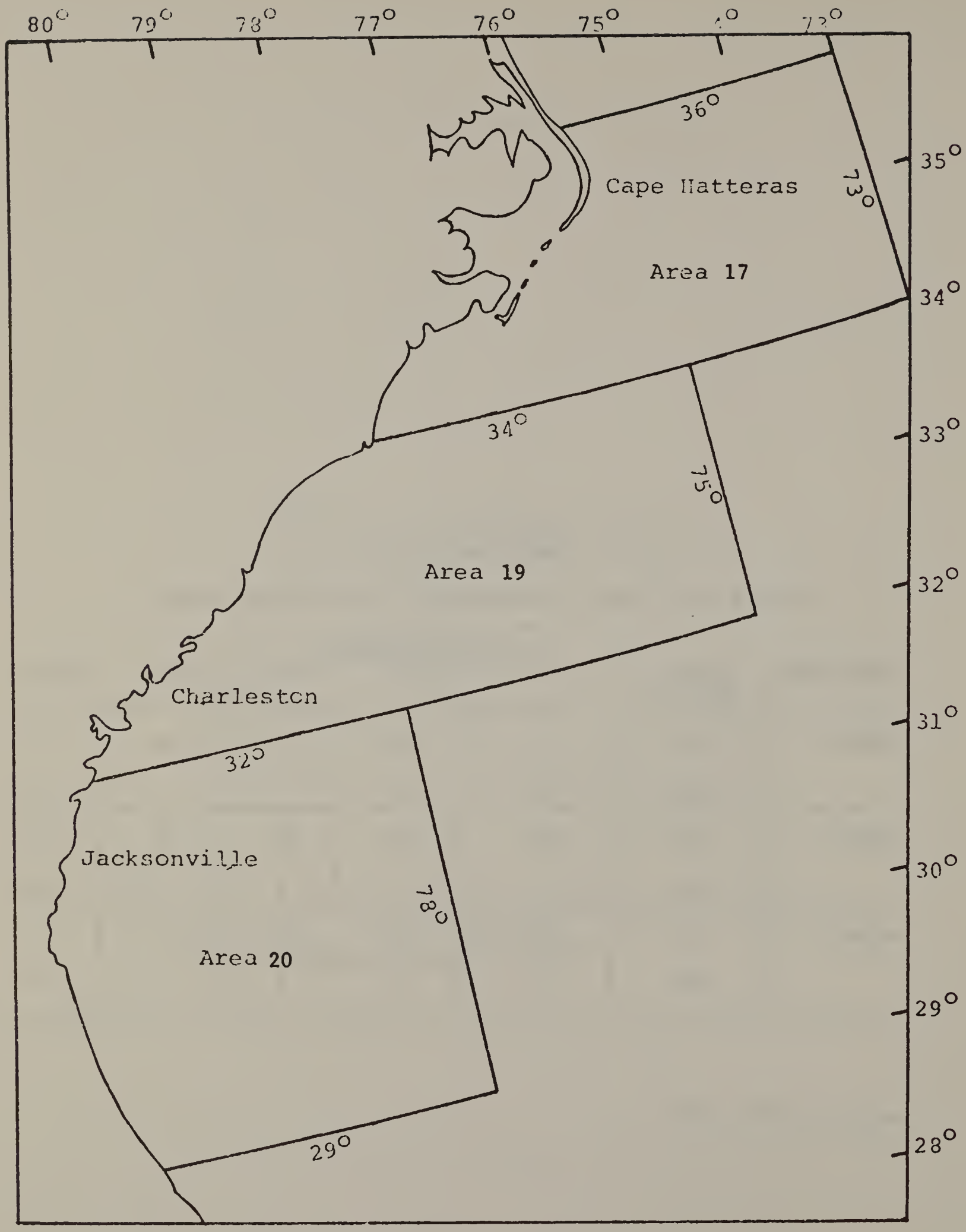
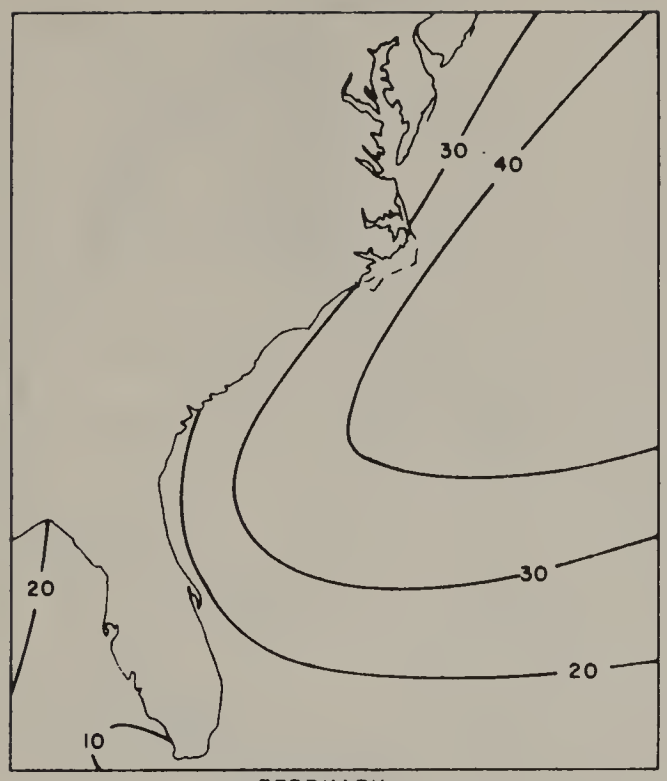
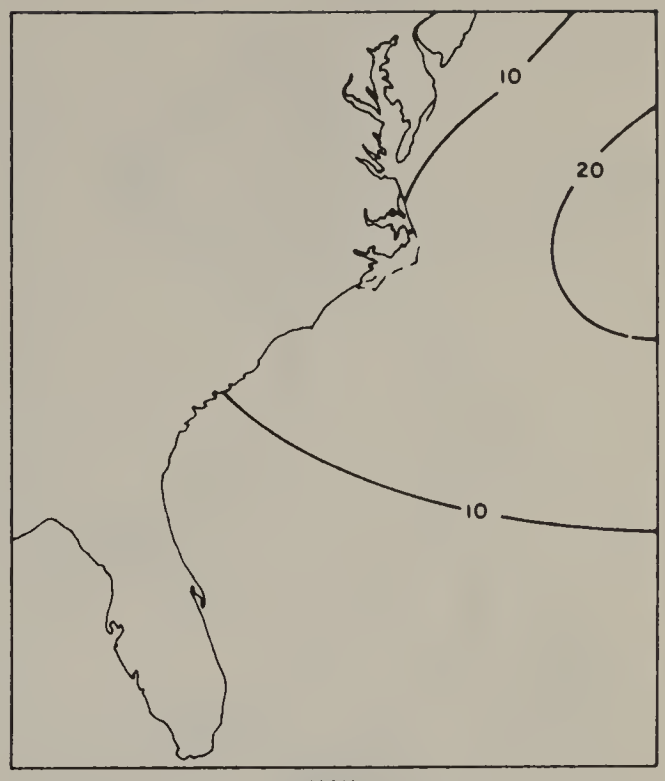


Figure B-35 Areas of SSMO Data (adopted from VIMS, 1974).



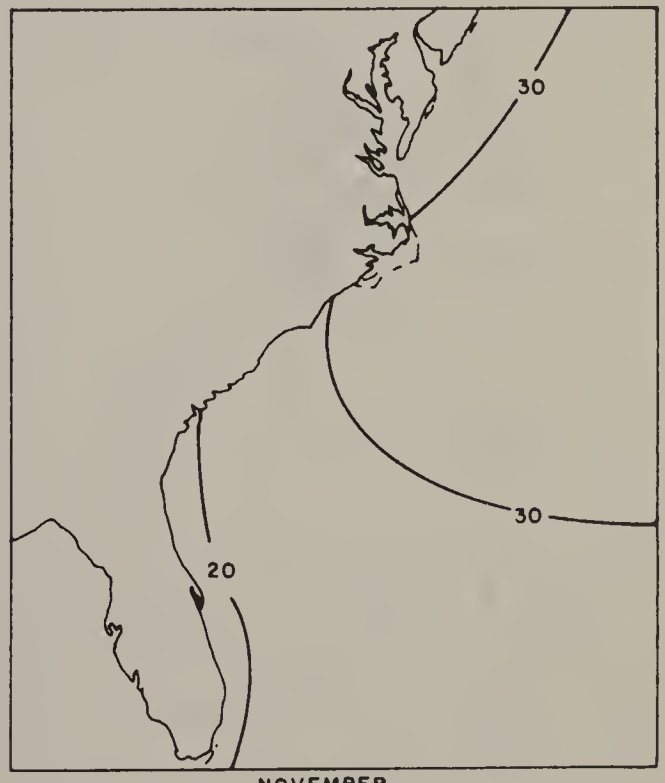
FEBRUARY



MAY

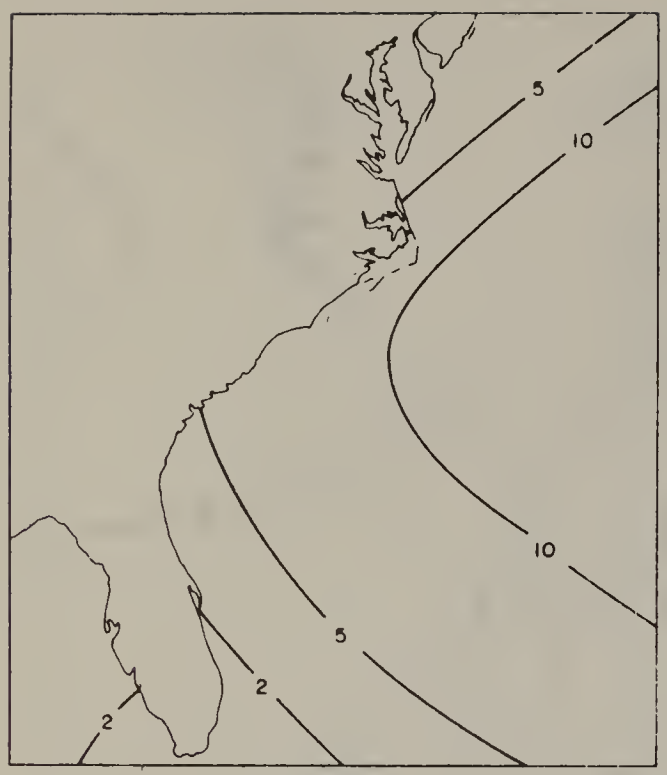


AUGUST



NOVEMBER

Figure B-36 Percent frequency of seas greater than 1.5 meters (5 ft.) (NOAA, 1973)



FEBRUARY



MAY



AUGUST



NOVEMBER

Figure B-37 Percent frequency of swell greater than 3.6 meters (12 ft.) (NOAA, 1973).

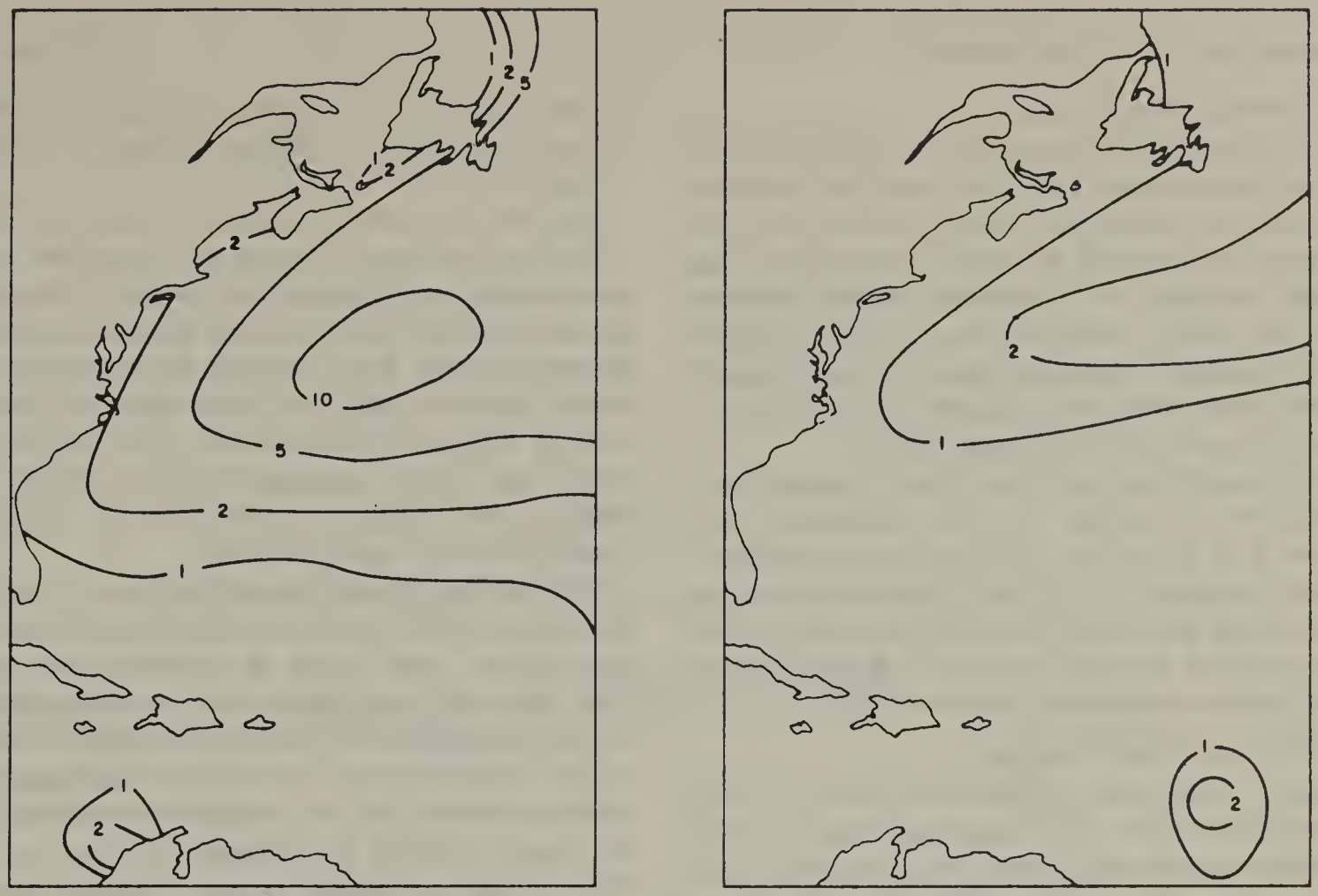


Figure B-38 Percent frequency of seas greater than 6 meters (20 ft.), (NOAA, 1973).

B. COASTAL WAVE CLIMATE

The typical deep water ocean waves discussed in the last section have long and low profiles. However, as waves pass into shallow area they steepen and decrease in velocity. Eventually, the orbital velocity of individual water particles becomes greater than the velocity of the wave itself. In general, depending upon the wave period, waves break when water depths reach 1.3 to 1.7 times the wave height (Shepart, 1973).

Surf records at four Coast Guard stations for a period from October 1954 to December 1956 (Table B-2) show that the onshore wave climate is greatly decreased from the offshore observations at the same time. Table B-2 illustrates that surf in these areas is generally less than 1.3 m (4 ft.) and hardly ever exceeds three meters (9 ft.).

5. Tides and Tidal Currents

Tides along the southeastern coast of the United States are semi-diurnal and thus have two complete cycles every lunar day. The tide at Cape Hatteras occurs approximately one hour later than the tide at Cape Canaveral. The spring tidal ranges vary from a maximum of 2.4 m (8 ft.) at Savannah, Georgia decreasing to the north, 0.9 m (3 ft.) at Cape Hatteras and to the south, 1.2 m (4 ft.) at Cape Canaveral (U.S. Dept. of Navy, 1959). The spring tidal range also decreases with distance from shore (Visual Nos. 6 N-S). The maximum range of tidal height on the continental shelf is approximately 0.6 m (2 ft.) with tidal currents up to 25 cm/sec (VIMS, 1974). In the open ocean, tidal currents are rotary in nature so that in a tidal cycle of 12.5 hrs., the direction of flow will have precessed to the right all compass directions. According to the 1976 Tidal Current Tables (U.S. Department of Commerce, 1976d):

> "A characteristic feature of the rotary current is the absence of slack water. Although the current generally varies from hour to hour, this variation from greatest current to least current and back again to greatest current does not give rise to a period of slack water. When the velocity of the rotary tidal current is least, it is known as the minimum current, and when it is greatest it is known as the maximum current. The minimum and maximum velocities of the rotary current are thus related to each other in the same way as slack and strength of current, a minimum velocity of the current following a maximum velocity by an interval of about three hours and being followed in turn by another maximum after a further interval of three hours."

The above reference provides the time of slack water and maximum current and speed for various estuaries and locations on the shelf. Tide prediction tables are also available giving an estimate (within one-half hour) of high and low tide for coastal stations. Figure B-39 illustrates the precession of tidal current directions. The ellipses indicate the relative magnitude of the currents as well as the variation of direction for different coastal stations, simultaneously.

The tides in estuaries lag behind those along the coast due to the travel time required in moving up the estuary. Tidal range in estuaries may vary from the coast depending upon local configuration of the embayment and weather conditions. Information on tidal currents in estuaries has been provided in Section II. 1. b. Above the upper limit of an estuary (defined by Pritchard (1967) to be the short transitional region where chlorinity drops from 0.06—0.01 ppt). There is a stretch of the freshwater river that is still subject to tidal influence. This tidal section of the river has sufficient flow to counteract the flow of the flood tide but still is subject to tidal variation in water elevation (Pritchard, 1967). Pritchard (1967) has also determined that the tidal elevation effect frequently ceases where the river bed rises above sea level.

6. Storm Surge

Storm surge along the southeastern Atlantic coast of the United States can be caused by hurricanes or strong northeasters (Figure B-40). Principal factors involved in the generation and modification of storm surge are wind stress, inverted barometer effect, and bathymetry and configuration of the local shoreline. Other factors which may have an effect on the storm surge are wave set up, rotation of the earth, second order coupling between astronomic tides and storm surge and rainfall (Jacobson, 1974).

When a component of wind blows normal to the coast, it causes a net transport toward shore resulting in a water level rise. The rise in sea level due to the fall in barometric pressure is approximately one centimeter for every millibar fall, under ideal conditions (Harris, 1963) (Figure B-41). The flat, wide continental shelf of the east coast of the United States often amplifies the ef-

Table B-2

Coastal Wave Climate, Southeastern U.S. Coastal Region (1955).

Location	Height (meters)	Percent Frequency February	May	August	November
Cape Lookout	0 - .61	13	15	NO	40
	.61 - 1.22	73	85	DATA	45
	1.22 - 1.83	14			10
	1.83 - 3.05				
Cape Fear	0 - .61	70	80	65	80
	.61 - 1.22	30	20	20	15
	1.22 - 1.83			10	
	1.83 - 3.05			5	
Brunswick	0 - .61	95	98	85	90
	.61 - 1.22	5	2	10	10
	1.22 - 1.83			5	
	1.83 - 3.05				
New Smyrna Beach	0 - .61	6	25	20	55
	.61 - 1.22	80	75	75	45
	1.22 - 1.83	6		5	
	1.83 - 3.05	2			

Source: Helle, 1953.

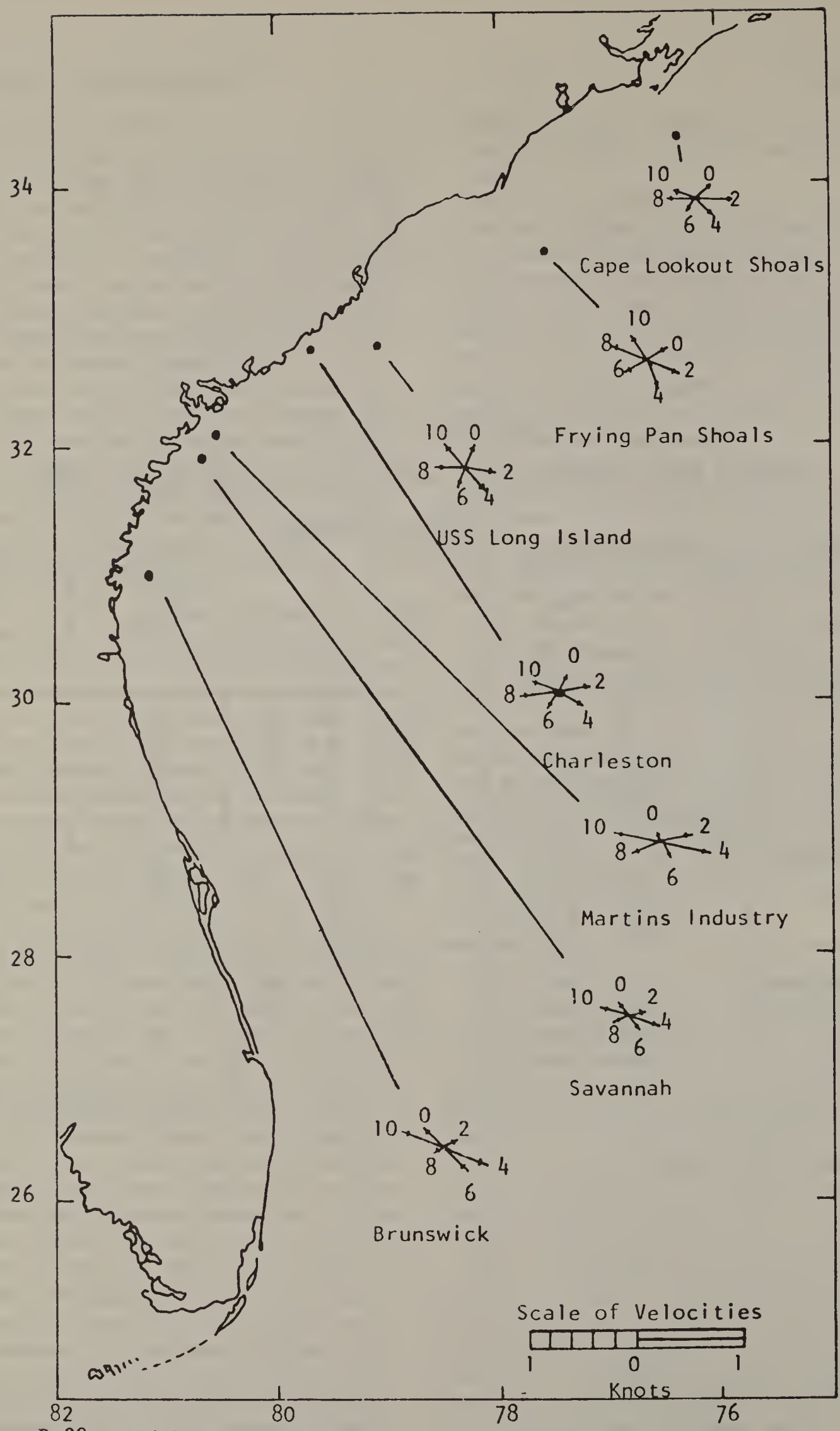


Figure B-39 Tidal ellipses on the shelf showing speed and direction of the tidal current for hours after the Greenwich Transit of the moon (Haight, 1942).

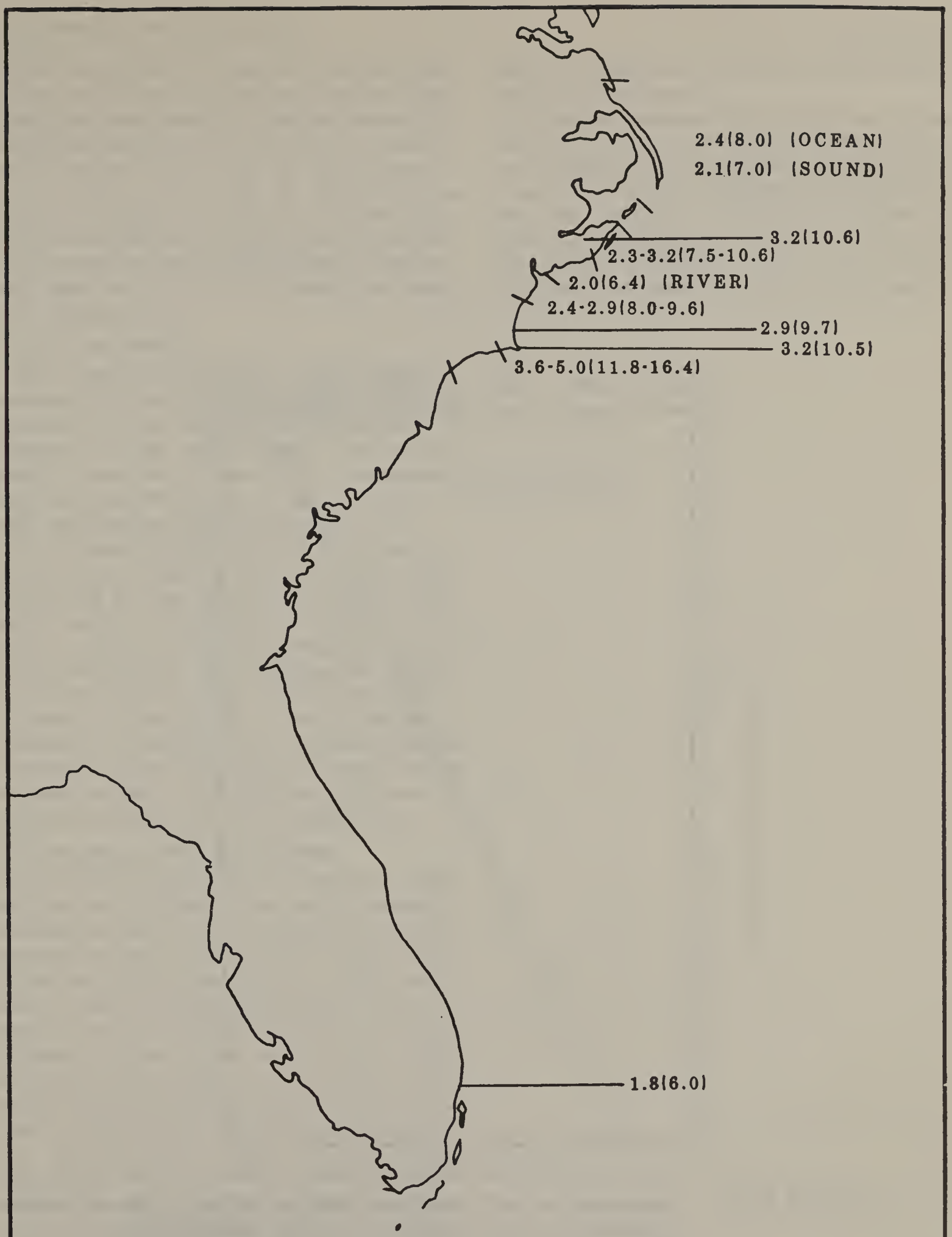


FIGURE B-40-OBSERVED STORM SURGE M(FT) ALONG THE SOUTHEASTERN UNITED STATES COAST. (DATA FROM PERDIKIS, 1967).

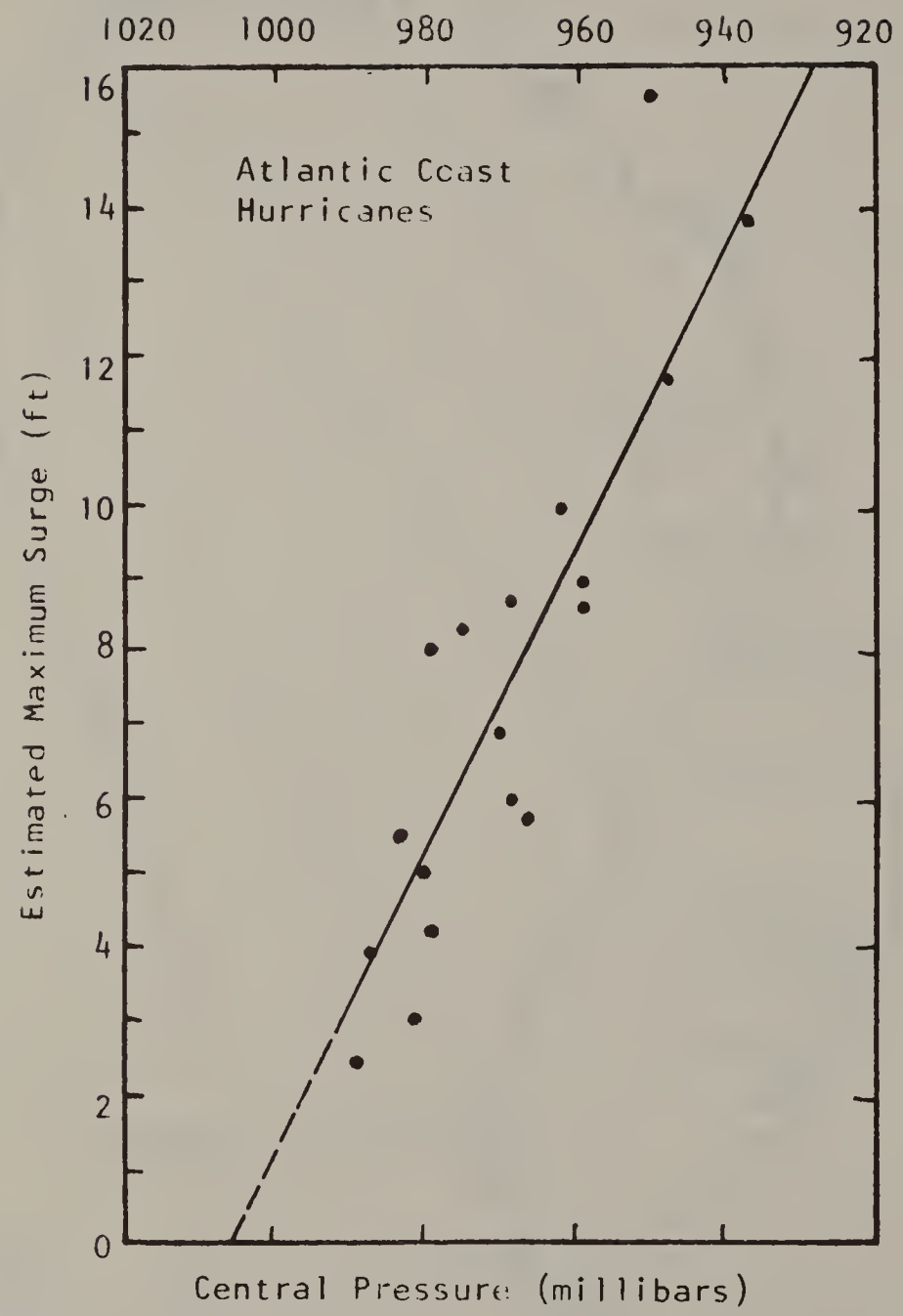


Figure B-41 Regression of maximum surge height on central pressure for Atlantic Coast hurricanes (Hoover 1957).

fect of storm surge. If storm waves approach perpendicular to the coast, this may trap the water being transported onshore inside the breaker line thus rising the water level. The water is unable to return through the surf zone and may amount to a 1.8 m (6 ft.) wave step up. Hurricanes can produce as much as 30.5 cm (12 in.) of rain during 24 hours resulting in a significant rise of sea level. Surge profiles for the coast of south of Cape Hatteras may be 4.3 m (14 ft.) (Dunn and Miller, 1960) (Figure B-42).

7. Sea Level Variation

The yearly mean sea level is determined by averaging the hourly sea level heights over one calendar year. The yearly variability is caused by variations in the meteorological and oceanographic parameters of wind, direct atmospheric pressure, river discharge, currents, salinity and water temperature (Hicks and Crosby, 1972).

As the yearly mean sea level is determined for a year, it is compared with data for previous years. From the data of previous years it is possible to postulate the trend of sea level. These trends result from tectonic, glacial-eustatic, or other climatological and oceanographic effects. The problem encountered in formulating such a hypothesis is that it can not be determined if variations are periodic or just segments of large oscillations. Figure B-43 shows a comparison of sea level variation for several tide gauge stations along the Atlantic coast of the United States.

8. Oceanographic Data Requirements

Section I.D.2. describes the environmental studies program of BLM. Further work is needed in a number of subject areas. The use of properly designed current meters placed at various depths as well as concurrent passive drift studies can be used to gain a better understanding of water circulation across the shelf and at the shelf slope boundary. Current meter surveys using shelf recording current meters have not been carried out and therefore there is a lack of knowledge about currents as they vary with time and depth over the entire shelf (VIMS, 1974). Although some information is available on salinity and temperature for selected portions of the shelf, more intensive sampling programs should be undertaken to clarify the physical oceanographic picture. The Gulf Stream has been studied more closely than other portions of the proposed sale area but parameters such as salinity and current velocity could be studied more closely to gain understanding of shelf circulation.

In the past estuaries have received more attention than the shelf water but information to determine classification and distance of tidal influence is needed. Coastal and offshore wave information must be obtained to facilitate the design and placement of offshore structures. Another area that deserves intensive study is the effect of weather on the physical processes of the shelf.

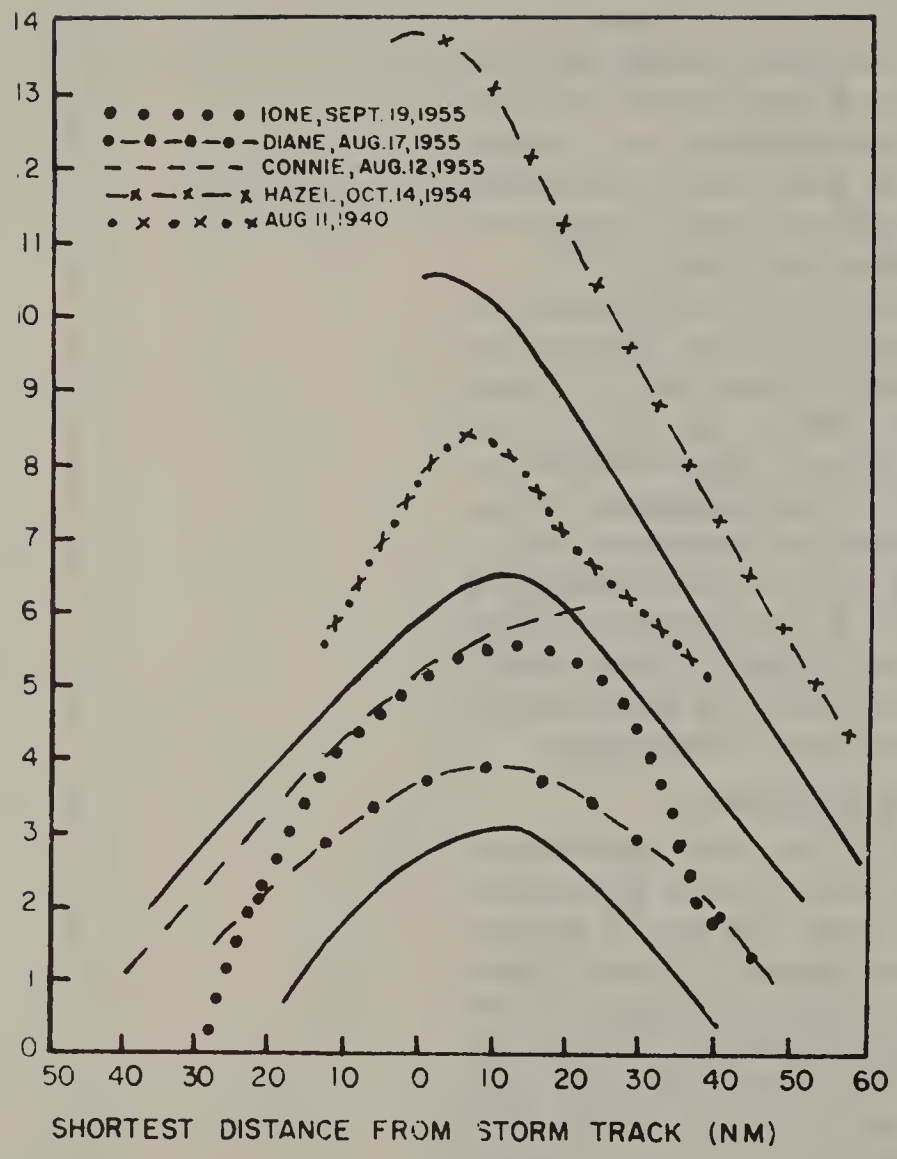


Figure B-42 Surge profiles of hurricanes which have entered the coasts of North Carolina, South Carolina, and Georgia (Dunn and Miller 1960).

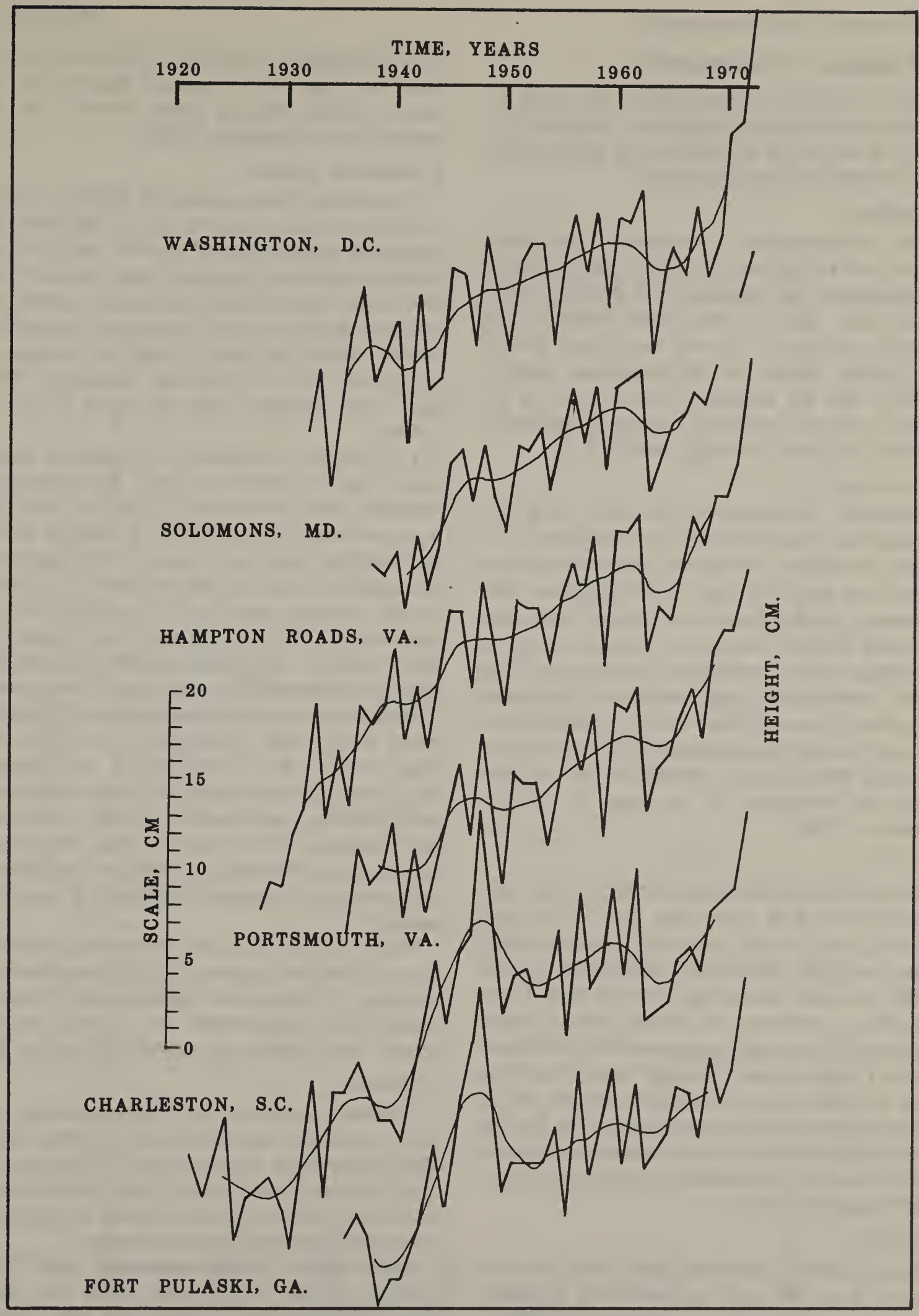


Figure B-43-Change in sea level with respect to adjacent land for stations from the District of Columbia to Georgia (Hicks and Crosby, n.d.).

C. Chemical Oceanography

Data on chemical oceanography were taken largely from information compiled by Roberts et al. (1974). More recent information on nutrients has been provided by Atkinson (1976).

1. Nutrients

The phytoplankton nutrients, phosphate, nitrate, and silicate are essential to the growth of phytoplankton and, therefore, are the base of the marine food chain. In the South Atlantic OCS nitrate in particular is in short supply and often is the limiting factor in phytoplankton growth. Nutrient data are available from all areas in the subject area as a result of cruises by Skidaway Institute and Duke University Marine Lab.

A. PHOSPHATE

Phosphate concentrations in the OCS are generally less than 0.2 um (0.2 x 10^{-6} Molar or 0.2 u gram-atoms/liter) and surface concentrations are usually less than 0.05 um. In the nearshore area phosphate concentrations are higher, especially near river mouths where 1.0 um is not unusual. In the offshore area subsurface intrusions of Gulf Stream water supply large amounts of phosphate to the shelf waters. While surface concentrations are zero, phosphate may reach 1.0—1.5 um at 50 m. These intrusions are thought to be the main source of phosphate to the area of interest (Atkinson, 1976).

B. NITRATE

Nitrate concentrations are very low in the shelf surface waters with values less than 0.1 um typical. Near river mouths concentrations are slightly higher but high biological consumption usually quickly reduces the amounts to less than 1 um. Subsurface intrusions of deeper Gulf Stream water supply large amounts of nitrate to the shelf waters. Concentrations typically reach 10-20 um at 50 m. This process supplies 20-50% of the nitrate required for phytoplankton growth. Nitrate is an excellent tracer of the intrusion process and provides quantitative estimates of their input and effect (Atkinson, 1976).

C. SILICATE

Surface silicate is always higher near the coast resulting from the high concentrations in runoff and the small biological consumption. Nearshore concentrations range from 1-20 um and offshore surface concentrations are usually less than 2 um. As with phosphate and nitrate, silicate is advected onto the shelf by intrusions. Because of this process silicate often is above 10 um in the subsurface waters (Atkinson, 1976).

2. Dissolved Oxygen

The surface concentration of dissolved oxygen over the southeast Atlantic coast shelf and slope during fall ranges from 4.17 to 5.01 ml/l. The concentration remains the same during winter except near shore where values increase to greater than five ml/l. During the rest of the year distributions remain about the same except for changes in pockets of low concentration nearshore. These data were obtained from the 1954 T. N. Gill cruise.

The vertical distribution of dissolved oxygen from Cape Hatteras to Cape Fear exhibits a decrease from greater than 4.5 ml/l at the surface to a minimum of 3 to 4 ml/l at a depth of 150-400 m during the winter and spring at both capes and the summer season at Cape Hatteras. The concentration increases again at 700 to 800 m at Cape Hatteras and 400 m at Cape Fear. During the other seasons, dissolved oxygen concentrations decrease monotonically with depth. The increase in dissolved oxygen is characteristic of North Atlantic Deep Water (Sverdrup et al., 1942). The data from the R.V. EASTWARD for a transect off Cape Lookout show the same distribution characteristics for dissolved oxygen. Stefansson and Atkinson (1967) showed that the oxygen minimum at mid-depths is a result of the intrusion of subsurface Caribbean water during some time periods.

Figure C-1 illustrates the variation of concentration of dissolved oxygen at 100% saturation as a function of salinity and temperature. Values of salinity and temperature for various seasons, depths, and locations are provided in Section II.B.

3. Salinity

The shelf water south of Cape Hatteras is fairly saline compared to coastal water further north. This high salinity results from, as mentioned before, low fresh water runoff and close proximity to the Gulf Stream. Isohalines tend to parallel the coast with largest gradients nearshore.

Shelf salinity varies seasonally with lower salinities in late winter and spring and higher values during summer and fall. The high salinities during summer and fall can be attributed to low runoff during that period and prevailing southeast

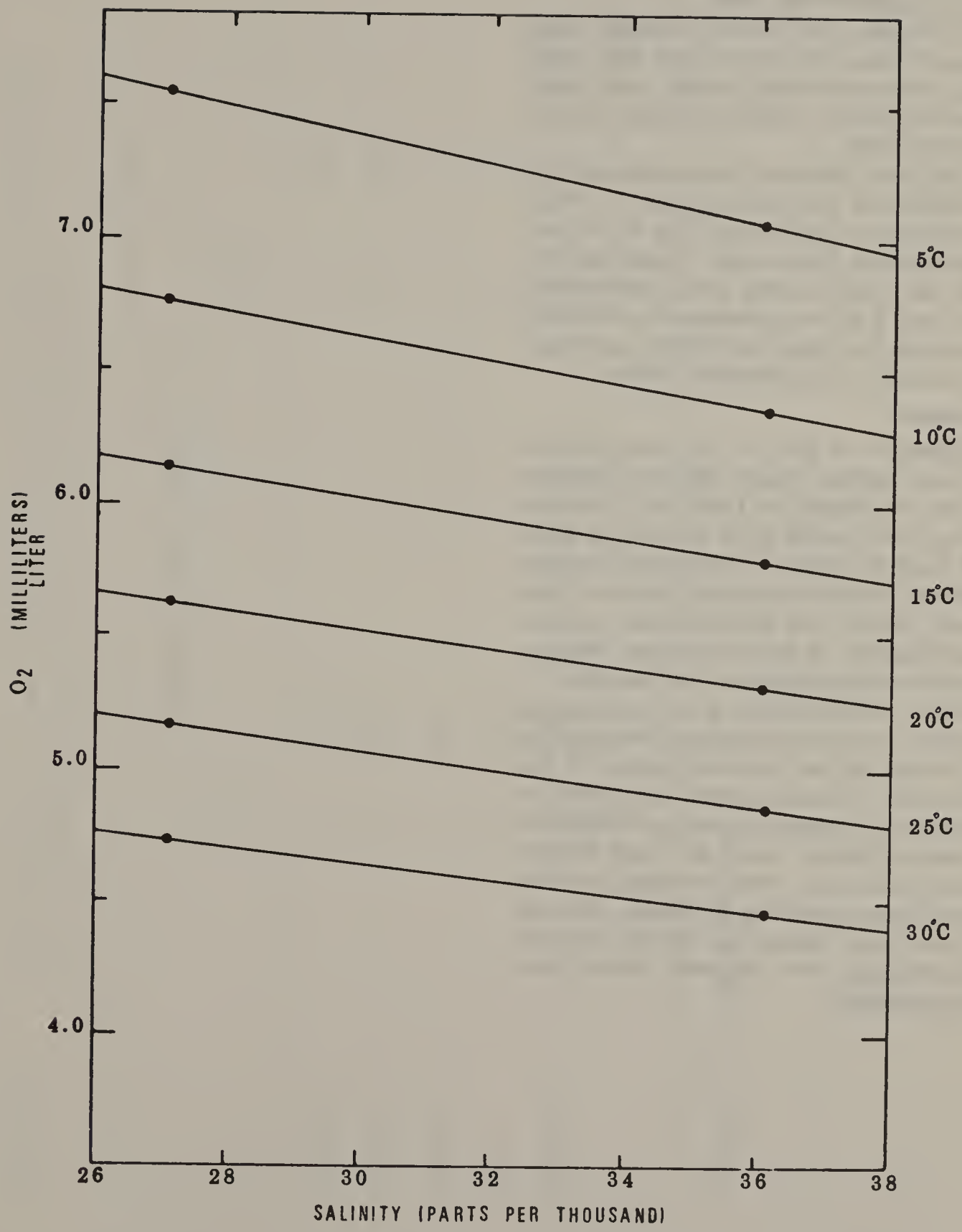


FIGURE C-1 OXYGEN CONCENTRATION AS A FUNCTION OF SALINITY AND TEMPERATURE AT 100 % SATURATION (SVERDRUP, 1942)

winds. Another factor that may result in higher salinities over the shelf is intrusion of Gulf Stream water (Stefansson et al., 1971). Prolonged occurrence of northeast winds may cause the intrusion of Virginia coastal waters, southward around Cape Hatteras thus significantly decreasing salinities in Raleigh Bay and to a smaller extent Onslow Bay. River runoff is the primary cause of low salinities in the area.

Surface salinities and bottom salinities may show a large variance at certain times. This vertical salinity variance depends largely upon meanders of the Gulf Stream, mixing and wind velocity (direction and speed).

Recent data from Skidaway Institute shows that surface salinities in the Gulf Stream are occasionally much lower than normal due to entrainment of Mississippi River water. Northward extensions of the Loop Current entrain Mississippi River water and it is then transported to the Gulf Stream, through the Straits of Florida, and then along the southeast coast (Atkinson, 1976).

4. Trace Metals

The distribution of Cd, Ni, Zn, and Hg for shelf and slope surface waters off the southeast Atlantic coast is depicted in Table C-1. The concentration of trace metals show a decrease from north (off South Carolina) to south (off Georgia-Florida) where levels approximate those of the Gulf Stream. There were no variations in trace metal concentrations as samples moved offshore except for Zn and Hg (high near river mouths).

The south to north increase in the trace metal gradient results from shelf flushing provided by the Gulf Stream. In the southern portion of the leased area Gulf Stream currents are closer to shore resulting in constant movement northward of trace metals Farther north, the Gulf Stream moves away from the coast resulting in the deposition of trace metals in sediments with no flushing. The trace metals are mostly derived from land drainage and industrial wastes and deposited accordingly.

Table C-1 Concentration of trace metals off the southeastern United States coast (from Windom and Smith 1972 and Windom 1973).

	Concentration (ug/1)				
	North		South		
Cadmium	0.11	(39)*	0.06	(18)	
Cobalt	0.17	(20)	0.06	(10)	
Nickel	1.0	(35)	0.3	(17)	
Zinc	7.4	(50)	2.2	(19)	
Mercury	0.17	(5)	0.02	(17)	summer
	0.08	(9)	0.04	(23)	winter

*Number of determinations.

D. Climatology of the U.S. South Atlantic Coastal Region

The description of meteorology was taken mainly from two sources which give the region very good coverage: The U.S. Department of Commerce (1975) and Ruzeki (1974).

1. Barometric Pressure

The Azores or Atlantic High is the center of the surface circulation system in this area. During the year it migrates a limited distance to the north or south and to the east or west, but is persistent throughout the year. The circulation over the eastern seaboard is controlled largely by the proximity of the Azores High.

During the winter the mean position of the Azores High is far out to sea. Major frontal systems developing over the continent and the Gulf of Mexico sweep over the Middle Atlantic states until the mountain ranges to the west partly obstruct their progress and cause considerable modification. Usually only the strongest polar outbreaks penetrate the southernmost points in the area. The rapidly changing air masses in the northern part of the area may be observed in variable temperatures from day to day and in the alternation between brief stormy periods followed by crisp, clear days. The contact between polar air masses of continental and maritime origin and tropical maritime air is greatest at this time. Consequently, winter storms are generally severe and are accompanied by strong, gusty winds.

During the spring the Azores High begins to move westward and northward. It affects the southern Atlantic coast where frequency of passing cyclonic storms decreases and the weather becomes more uniformly warm and humid. The northern part of the area, still at the outer edge of the High, is subject to frontal activity and changing air masses. Warm spring rains usually alternate with mild weather. It is not uncommon, however, for the Azores High to dominate the entire area in this season, bringing summer heat and enervating humidities.

In summer, the center of the Azores High has moved to its northern limit and extends over the entire eastern seaboard. The intensity is moderate but persistent, blocking the eastward movement of the continental pressure systems. For weeks at a time the weather on the coast may not change significantly. This season is characterized by frequent instability, showers and thunderstorms, high temperatures and humidities, and relatively low wind velocities.

During the fall the Azores High retreats southward and eastward, leaving the Atlantic coast under the influence of a weak continental high-pressure zone. The weakening of the pressure system indicates the gradual transition to the winter pattern accompanied by increased frontal activity, particularly in the northern part. The weather is usually cool and fine, interrupted by brief rainy periods associated with the passage of fronts.

The pressure pattern changes considerably over the area from winter to summer. At individual stations, however, the seasonal variation in mean pressure is only 3.04 to 4.33 mm (0.77 to 1.1 in.) through the year. Extremes vary considerably more than this. During the summer the mean pressure remains low and steady, but begins to rise again in September and continues to rise through the remainder of the year.

2. Surface Winds

In winter, over the northern part of the sea area (north of latitude 30°) predominant winds are from the northwest quadrant. Southwest winds are also frequent (Figure D-1). Along the coast north of latitude 35°, wind directions are variable, though predominantly from the northern quadrant. Along the middle coast, directions are mostly from the western quadrant. Along the Florida coast, south of latitude 30°, easterly winds are prominent throughout the year.

Winter storms over the entire area are modified by the Appalachian Mountain range. However, even the extreme southern portion occasionally experiences northwesterly winds when the severest of the winter storms penetrate this far south.

In spring, over the northern part of the sea area (north of latitude 30°), winds from the southwest, south and northeast are equal in frequency. Along the caost (north of latitude 35°) southwest winds predominate. North and south winds are also frequent. Along the middle coast, south and southwest winds predominate.

In summer, the persistence and dominance of the Azores High is shown in the increasing frequency of southwesterly winds over the northern part of the sea area (Figure D-2). Along the coast (north of latitude 35°) southerly winds predominate. Along the middle coast southwest winds predominate.

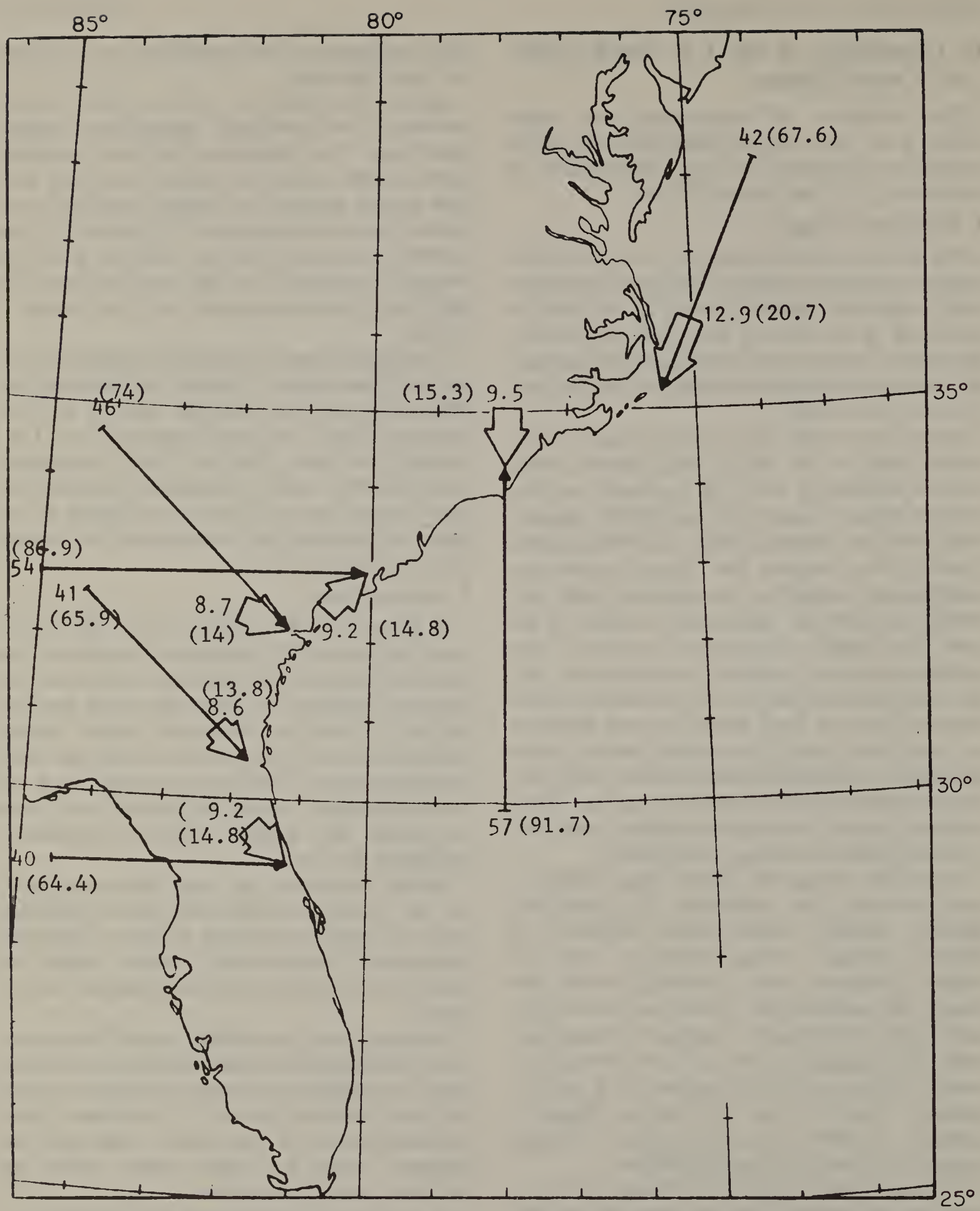


Figure D-1 Surface Winds at Shore Stations for January. Broad arrows indicate mean wind direction. Thin arrows indicate highest recorded wind direction. Arrow lengths are proportional to velocity. Wind speeds are indicated at the base of each arrow in mph (figures in parenthesis are kph.) (Ruzeki, 1974)

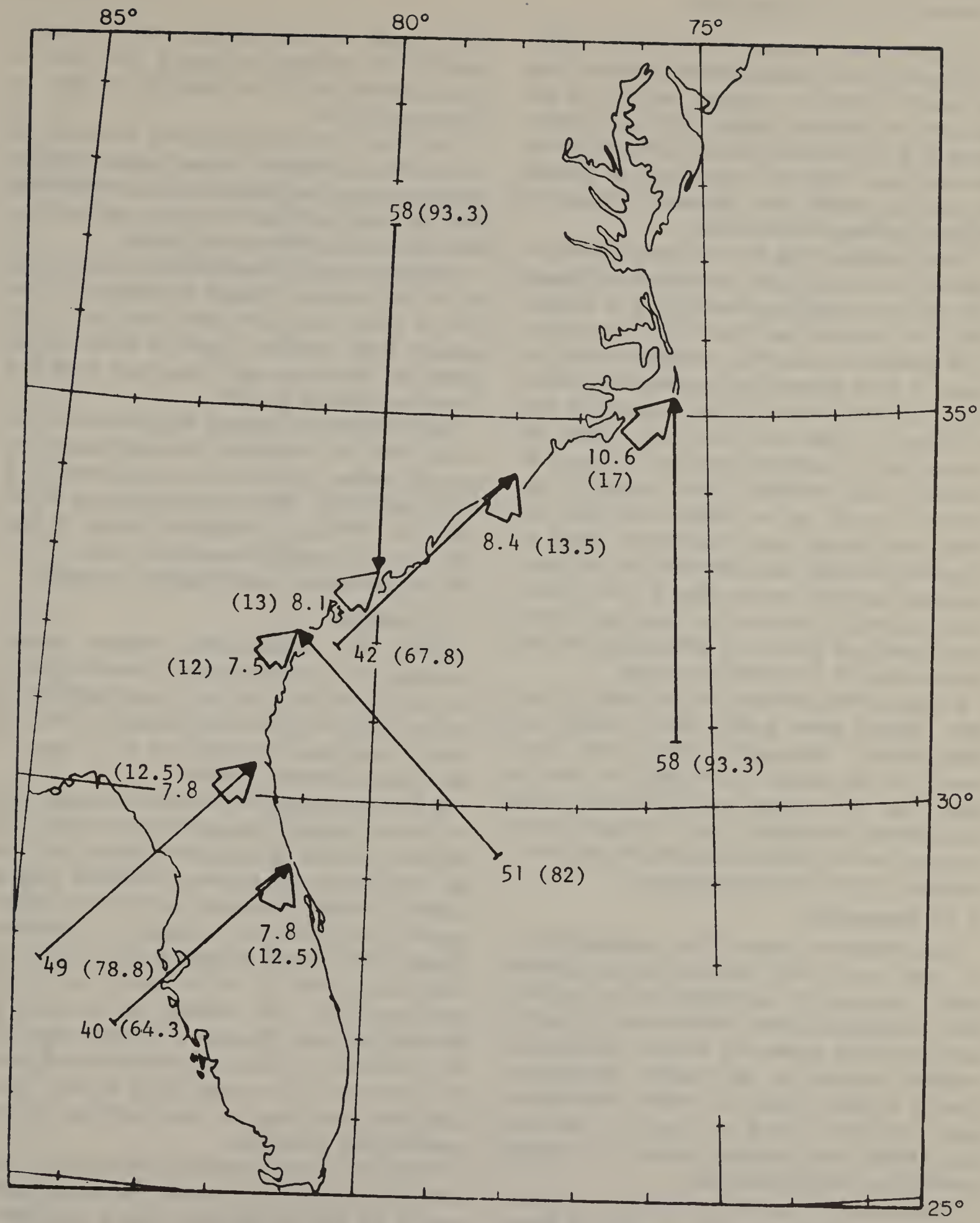


Figure D-2 Surface Winds at Shore Stations for July. Broad arrows indicate mean wind direction. Thin arrows indicate highest recorded wind direction. Arrow lengths are proportional to velocity. Wind speeds are indicated at the base of each arrow in mph (figures in parenthesis are kph.) (Ruzeki, 1974)

In autumn the recession of the Azores High, accompanied by changing pressure systems along the coast, results in a sharp increase in the frequency of northerly winds which are recorded about 50% of the time over the northern part of the sea area. Along the coast (north of latitude 25°) and the middle coast (between 30° and 35° latitude) northerly winds prevail.

Wind velocities along the southeastern coast are generally moderately light, averaging 8 to 12 knots over the year. Monthly averages vary in summer from 6 to 10 knots, and 8 to 15 knots in winter. Wide departures from these averages should be expected in all seasons. In the immediate coastal area, the windward side of the promontories may be lashed by gales and heavy seas, while the leeward side is relatively protected. Averages do not show these variations. Cape Hatteras is particularly exposed to the winds, with open sea from north through east to southwest. South of Cape Hatteras gale winds are much less frequent, occurring generally on less than 15 days a year. The frequency of calms is less than one percent in the north and from 15 to 20% during the year at most places in the middle and south.

Extreme wind velocities are a hazard at any time. Though winds greater than 34 knots are comparatively infrequent, they have been recorded at all stations in this stretch of coast at almost any time of the year (Table D-1). Gale winds usually accompany sharply defined frontal systems, severe cyclone storms, hurricanes or occasionally severe local thunderstorms.

3. Air Temperature

The temperature regime of the southern Atlantic coast varies from temperate in the northern part of the area to subtropical in the southern part. The gradation from north to south is regular, increasing with decreasing latitude. Another interesting variation is the general modification process of the ocean and coastal temperatures upon each other. Along the coast, the sheltered land stations have warmer summers and cooler winters than do exposed points.

Temperatures along the southeastern seaboard region are conducive to a long period of small-craft operation.

The southern Atlantic coast minimum monthly air temperatures range from 9°C at Cape Hatteras, North Carolina (Figure D-3) to 19°C at Miami, Florida (Figure D-4) in January. July is the warmest month at most stations with maximum monthly air temperatures ranging from 29°C at Cape Hatteras to 28°C at Miami (U. S. Dept. of Commerce, 1972).

Over water, the coldest month is February and the warmest is August. Exposed coastal stations experience mean air temperatures more like those over the water than those over land, and have annual extremes in February and August.

The daily range in temperatures averages from 6°C to 8°C at coastal stations throughout the year and is likely to be less over the water. The greatest daily variation occurs at most stations during the winter and early spring and the lowest during late summer and fall.

Very little data on extreme temperatures for the ocean areas are available. Although uncommon, coastal stations have recorded temperatures of 38°C (100°F). The highest temperature on record was 41°C (106°F) at Jacksonville, Florida, in July. The lowest recorded temperature was -12.8°C (9°F) at Charleston, South Carolina, in January.

4. Precipitation

Along the southeastern seaboard region, precipitation is moderately heavy, averaging about 121 to 142 cm (48 to 56 in.) a year. Monthly departures may be large in any individual year, but over a long period of record, 50 to 75 years, a fairly uniform pattern prevails.

In the northern part of the area, maximum rainfall occurs normally during July and August, and minimum rainfall in November (Figure D-5). In the southern section, however, maximum rainfall occurs in August, September or October, and the minimum in December, January or February (Figure D-6). Average monthly totals at most stations range from 51 to 152 mm (2 to 6 in.) throughout the year. During the months of greatest hurricane frequency, excessive rains of 23 to 38 cm (9 to 15 in.) in a 24-hour period have been recorded. These may occur at any point along the coast, but are most common in the southern part of the area.

The monthly mean number of days with 2.5 mm (0.01 in.) or more of precipitation in the northern part of the area ranges from about 8 to 10 days a month in the fall to 10 to 12 days a month in the summer and winter. In the central part of the area the most rainy days are in summer, 11 to 16 days a month, and the least in the spring and fall, six to nine days a month. The most rainy days

Table D-1 Percent of the time winds are greater than or equal to 34 knots (39 mph, 62 kmph), the wind speed at which damage begins to occur. Data is based on ships traveling near the coast, biasing the figures toward good weather as they avoid the worst storms. (Dept. of Commerce, 1975)

COASTAL STRETCH	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Cape Hatteras Area	8.8	7.5	4.7	2.1	1.9	1.4	0.2	0.2	2.5	3.9	3.7	2.7
Cape Fear to Savannah	5.6	5.9	4.5	1.0	1.6	1.0	0.5	0.2	1.8	6.7	3.4	3.1
Savannah to Ponce de Leon Inlet, Florida	2.4	4.5	1.7	0.6	0.7	1.4	o.4	0.1	2.7	2.9	1.9	2.0
Ponce de Leon Inlet to Florida Keys	0.8	1.6	0.5	0.1	0.2	0.4	0.1	0.2	1.9	2.0	0.7	0.8

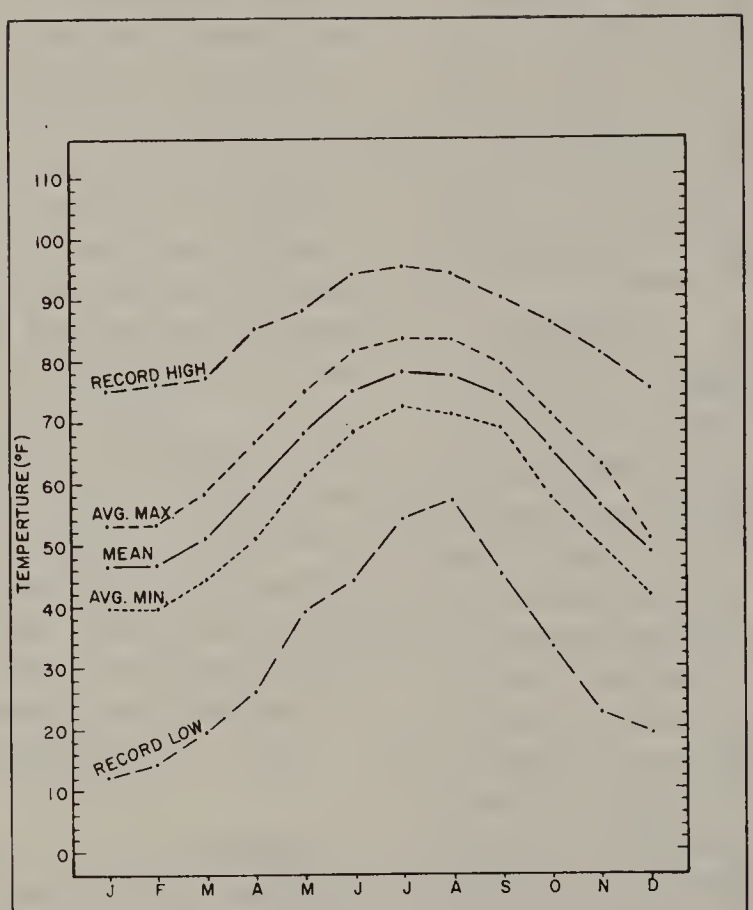


Figure D-3 Monthly air temperatures (°F) for Cape Hatteras, N. C. showing (top to bottom) record highest, average daily maximum, daily mean, average daily minimum, and record lowest temperatures for each month. (Ruzeki, 1974)

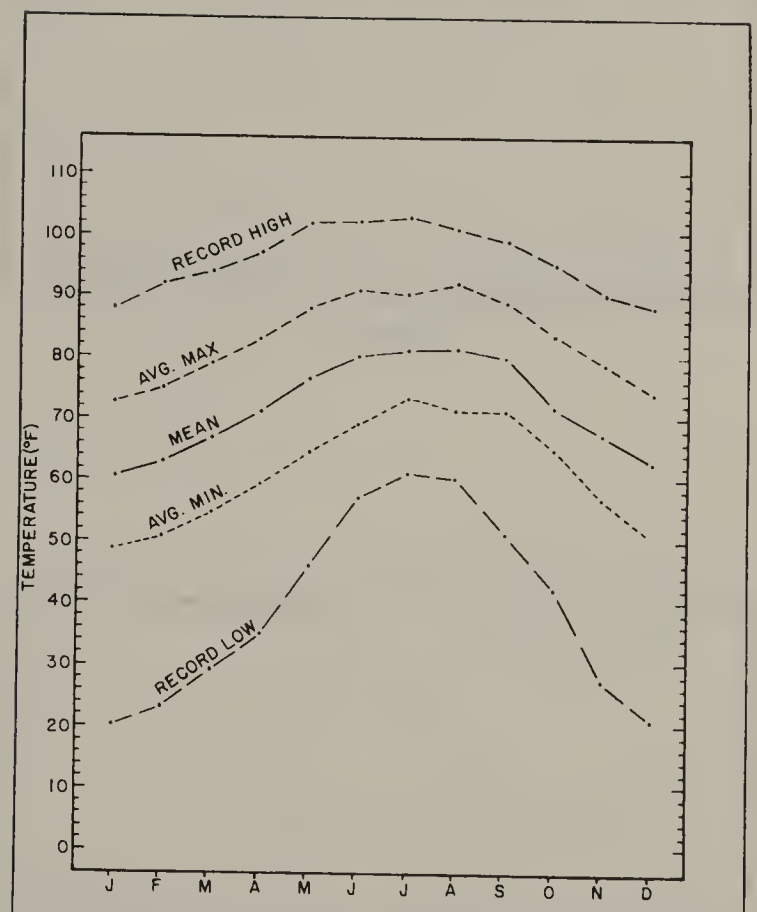
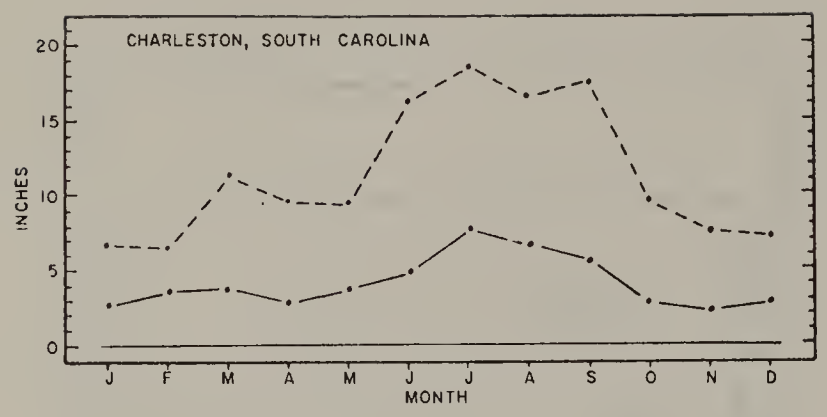


Figure D-4 Monthly air temperatures (^{o}F) for Titusville, Fla. showing (top to bottom) record highest, average daily maximum, daily mean, average daily minimum, and record lowest temperatures for each month. (Ruzeki, 1974)



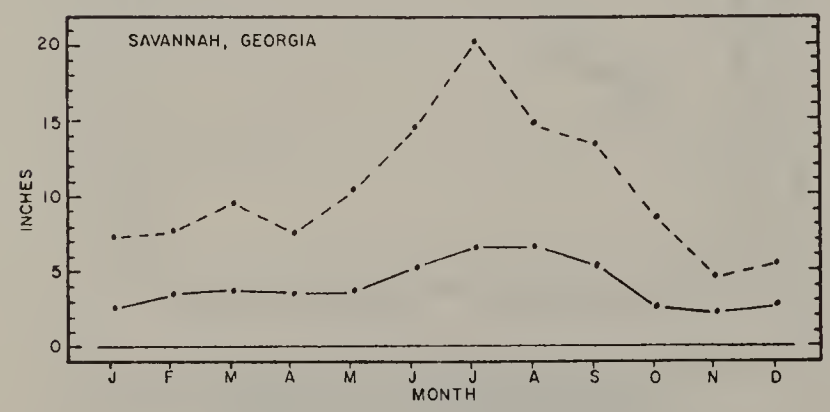
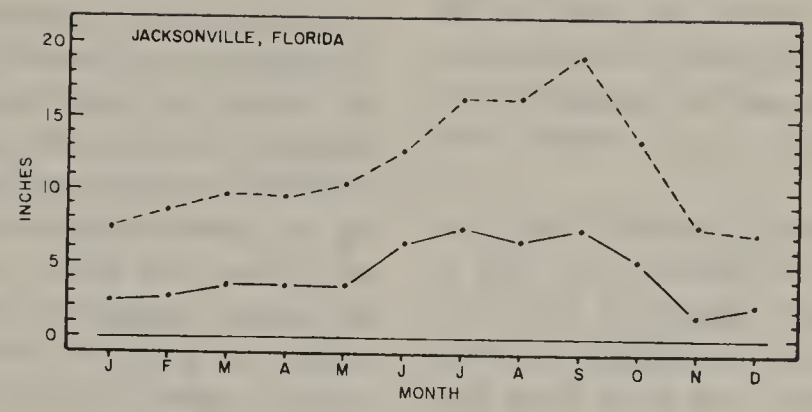


Figure D-5 Normal total monthly precipitation (lower line) and Maximum monthly precipitation (upper line.) (Ruzeki, 1974)



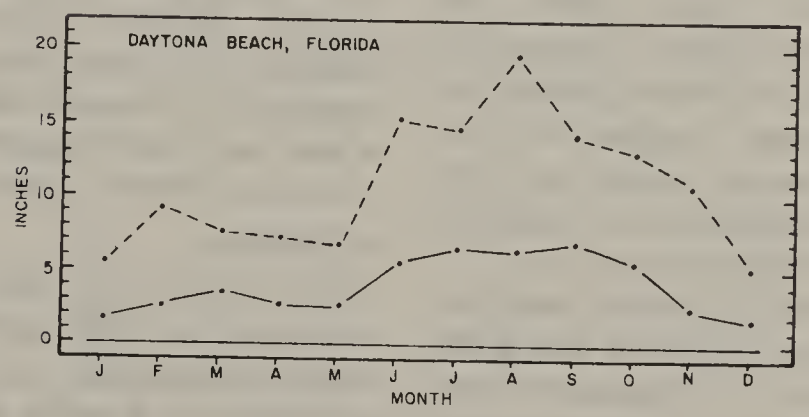


Figure D-6 Normal total monthly precipitation (lower line) and Maximum monthly precipitation (upper line.) (Ruzeki, 1974)

along the Florida coast, 14 to 18 days a month, generally occur in late summer and early fall, and the minimum number, five to eight days a month, from February through April.

Much of the precipitation is associated with cyclonic activity throughout the year. During the winter, precipitation is usually general, but may come with occasional thunderstorms associated with fronts. During the summer, when the area is dominated by the Azores High and cumulus clouds predominate, precipitation is localized and is showery in nature.

Thunderstorms along the coast occur on an average from 40 days a year in the north to 80 days a year in the south. Maximum occurrence is from June through August, and an average of 7 to 19 thunderstorms a month occur during this season.

Snow falls from December through March in the northern part of the area one or two days a month. As far as coastal operations are concerned, snow precipitation is not significant since most of the area is entirely free from snow the year round.

5. Relative Humidity

Mean relative humidity is highest from July through September and lowest in April and May. Relative humidities over water areas are uniformly high ranging from 72% in January to 81% in July. The presence of minute particles of salt in the air over the ocean, together with the high moisture content in the air, results in a very corrosive effect upon equipment and supplies, both on the water and at nearby shore points.

The general daily trend in relative humidity shows a decrease as the air is warmed during the day. With the exception of Savannah and Jacksonville, winter humidities are highest during the early morning hours before warming has begun, whereas summer humidites are highest at night. The smallest daily range in relative humidity occurs at Cape Hatteras where average January humidities range through 12 percentage points and those in July through 20 percentage points. Largest ranges are at Jacksonville with 28 percentage points in April and 30 in September. Average humidities range from evening values of 46 percentage points at Savannah in March to 1:00 a.m. values of 92 percentage points at Charleston and Daytona Beach in August.

6. Visibility and Sky Cover

Visibility is generally good throughout the year over the entire area. Fog is the principal restriction to visibility. In general, fog decreases from north to south, and the worst fog conditions occur during the winter when air masses change frequently. Visibility is usually poorest during the night and early morning.

In addition to fog, precipitation occasionally reduces visibility over both land and water, and haze and smoke sometimes restrict visibility over land.

A. FOG

Along the coast, radiation fog is frequent, forming shortly after sunset. These fogs generally do not extend any great distance seaward, but may seriously restrict harbor activities. Sea fogs sometimes drift onshore on hot summer days, persisting for many hours in a shallow layer along the coast. Over the land, dispersal usually begins at the surface giving the effect of lifting. Over the water, fog generally persists at the surface and restricts visibility until the last vestige of the formation disappears.

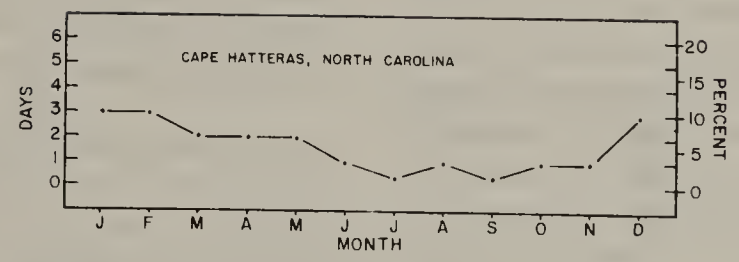
The occurrence of heavy fog at land stations between Cape Hatteras and Cape Canaveral varies from an average of six days during January at Daytona Beach to less than one day a month at Cape Hatteras during July and September (Figures D-7 and D-8). Heavy fog is most frequent at Savannah with an average of 44 days a year and least frequent at Wilmington with an average of 25 days a year.

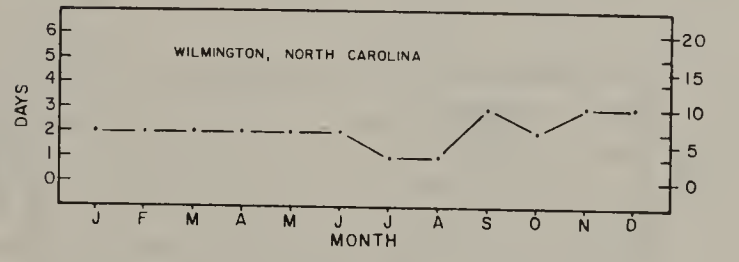
B. SUNSHINE

The area as a whole experiences monthly averages from 52% to 80% of possible hours of sunshine during the year. In the north, the largest percentage of possible sunshine occurs in spring and fall and the smallest percentage in winter. In the overall picture, the extreme south and a narrow belt in the north-central part of the area shows a greater percentage of possible sunshine than the northern and south-central sections.

C. CLOUDINESS

Cloudiness over the area is moderate to moderately high throughout the year, averaging from 35% to 65% sky cover. In general, however, the cloudiest month is January in the northern sections and over most of the water areas, and may be any month from June through September





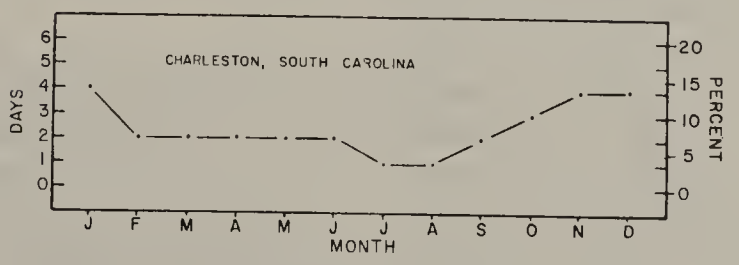


Figure D-7 Mean Number of Days with Heavy Fog. (Ruzeki, 1974)

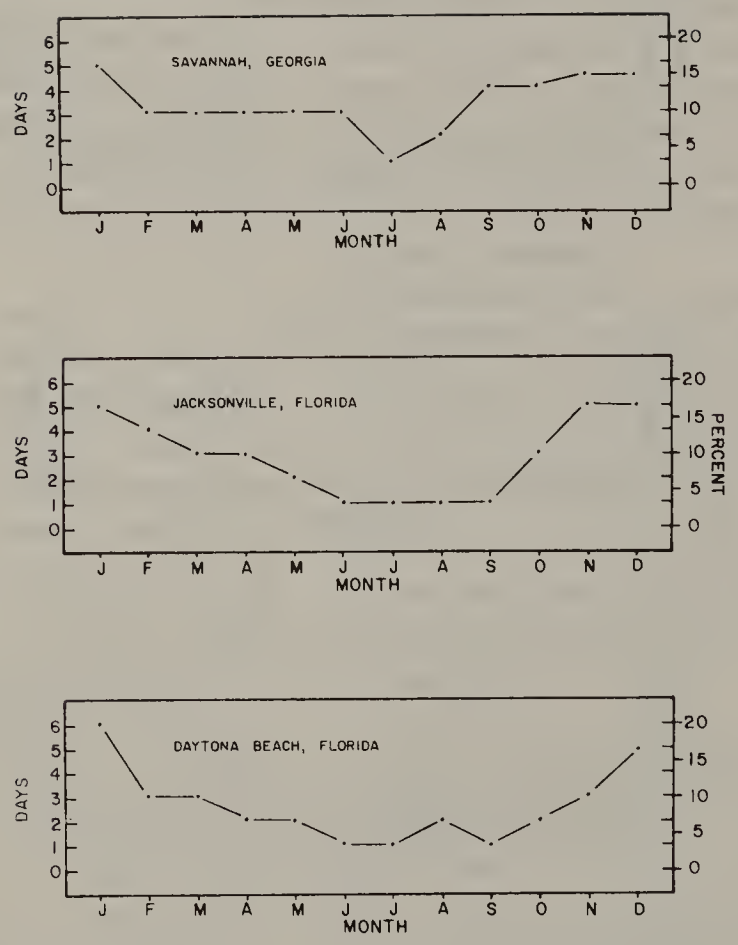


Figure D-8 Mean Number of Days with Heavy Fog. (Ruzeki, 1974)

in the southern section. At most of the individual stations in the northern part of the area, the least average cloudiness occurs in October and in the extreme southern part, the least cloudiness occurs in February or March.

Since the air usually contains moisture, only a small decrease in temperature is necessary to cause condensation and cloud formation. At the edge of the warm northward-moving Gulf Stream and the cool southward-moving countercurrent which skirts the shore from Cape Hatteras, N.C., to Jacksonville, Fla., sharp contrasts in temperature result in the formation of heavy stratus clouds which may appear very much as a cold front. These clouds may persist for days at a time if the wind is light and they may be carried inland by northeasterly winds. Such cloudiness is common during the spring when the gradient between shore water and Gulf Stream temperatures is steepest.

The fact that the maximum cloudiness for the year occurs during the winter at northern coastal stations may be explained by the maximum frequency of cyclonic storms passing northward or north-eastward from the central or south-central section during that season. These rarely affect the extreme southern part of the area.

Much of the cloudiness over the entire area is of the cumulus type, resulting from either the unstable conditions that accompany cyclonic activity in all seasons, or the general air mass instability during the summer. Such clouds frequently form over land during the day and drift seaward at night.

7. Tornadoes and Waterspouts

Funnel clouds, tornadoes and waterspouts are different types of the same phenomenon; the latter two being funnel clouds which have extended downward to the ground or water surface respectively. A total of 208 of these meteorological features have been reported in the coastal area between 1960 and 1972.

Tornadoes are usually associated with cyclones, both tropical and extratropical. Movement of over 60% of tornadoes reported in the U.S. is generally from southwest to northeast (Figure D-9). Although highly destructive, tornadoes are the smallest of severe weather distrubances, and are limited in duration as well as in areal extent of path. These paths vary from a few meters to several hundred meters in width and can extend from a few hundred meters to over 482 km. The average width and length of tornado paths in the U.S. are 366 m and 26 km.

Tornadoes generally travel at speeds of about 64 kmph, however, these forward speeds range from 0 to 109 kmph. Top wind speeds within tornadoes appear to usually be between 160 and 320 kmph and are seldom greater than 400 kmph (NOAA, 1977).

8. Tropical Cyclones, Tropical Storms, Hurricanes and Great Hurricanes

Tropical cyclones differ from extratropical cyclones in that extratropical cyclones obtain their energy from the variances of temperature and moisture in air masses within the circulation; whereas tropical cyclones obtain energy from the latent heat of condensation of water vapor. The average diameter of a tropical cyclone is between 96 and 965 km at maturity.

Tropical cyclones are classified by stages according to the sustained surface wind speeds. The most intense stage, called a great hurricane, has winds in excess of 201 kmph. The hurricane has sustained surface winds from 119 to 199 kmph. Tropical storms have sustained winds 62 to 117 kmph. Tropical depressions have sustained winds not exceeding 61 kmph.

Location and environment determine the development and dissipation of tropical cyclones. They form in ocean areas having a high surface temperature 25°C to 27°C with the greatest number occurring in the late summer and early fall in the Northern Hemisphere. After formation, the pull of the Easterlies causes a tropical cyclone to make a curved path from east to west. In some instances, tropical cyclones will reverse their direction of travel, a phenomenon called "recurving". If the storm's tract crosses over land, the storm rapidly dissipates as a result of the removal of the oceanic energy source.

The coastal region has generally experienced tropical cyclones of one type or another as early as May 28 and as late as December 2 (Figure D-10). The portion of the region near Miami is the most likely to experience a hurricane in any one year (16% probability). Probability drops to less than two percent northward along the coast in the Jacksonville area, rises back up to eight percent in the Charleston area, and stays uniformly high, peaking again at 11% probability at Cape Hatteras.



Figure D-9 Tracks of all tornadoes for the period 1916-1950 (from Weather Bureau Technical Paper No. 20, 1952).

EARLIEST AND LATEST TROPICAL CYCLONE OCCURRENCES 1886-1970

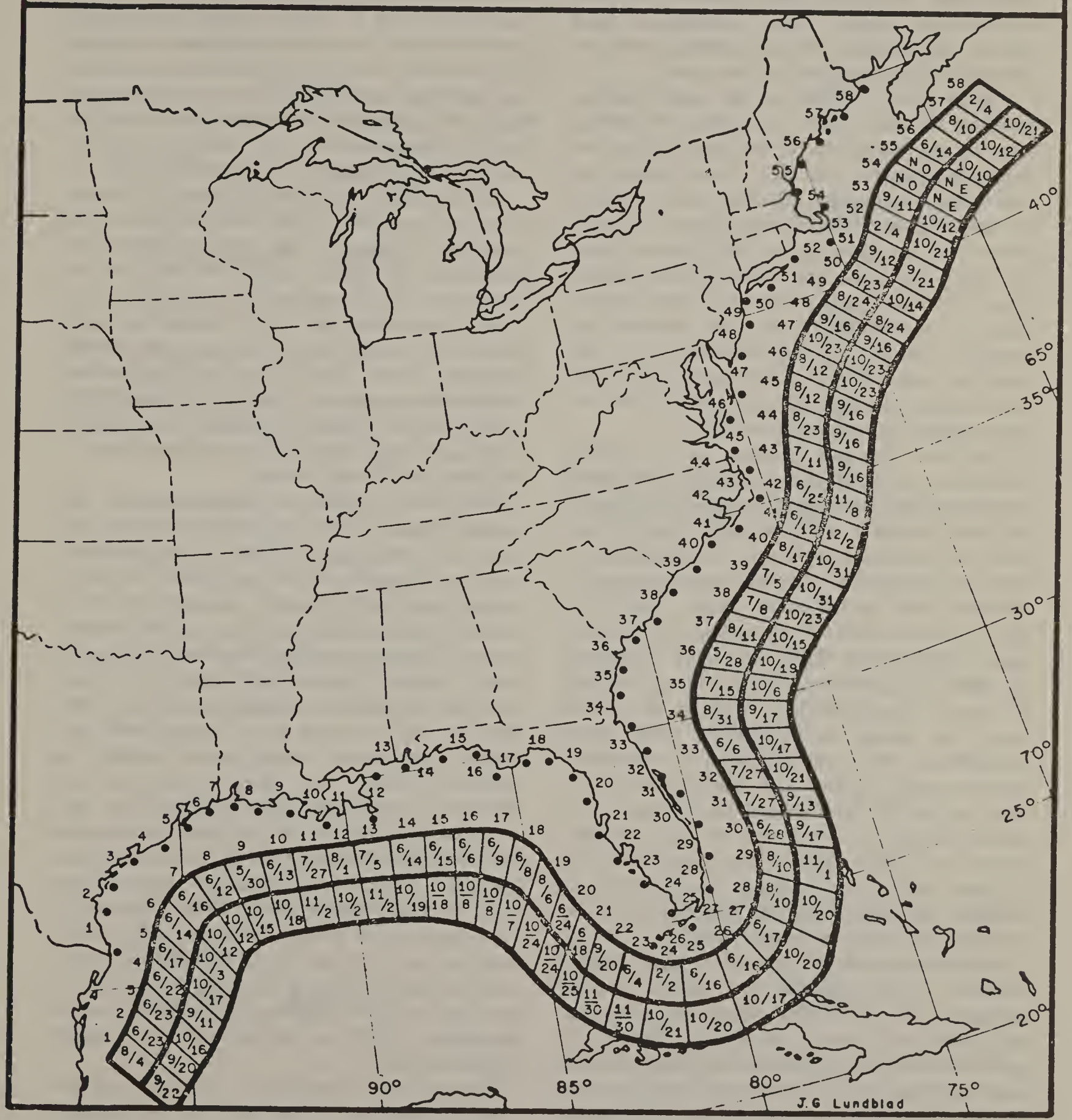


Figure D-10 Numerals indicate coastal strips approximately 50 nautical miles in length. (U.S. Dept. of Commerce, 1972)

E. Biological Communities

1. Offshore and Nearshore

A. PHYTOPLANKTON

Roberts (1974) summarized several sources of information concerning phytoplankton occurring in southeast United States' continental shelf waters. The majority of the following narrative has been taken from Roberts' discussion.

Hulbert (1967) reported on the phytoplankton collected in April, 1965, at a series of stations (four on the shelf, four in the Gulf Stream and five in the Sargasso Sea) on a transect nearly due east from Jacksonville, Florida. The dominant species of phytoplankters were diatoms in shelf waters and coccoliths in the Gulf Stream. These organisms are most important in deep waters where attached vegetation and land derived nutrients are diminished. Table E-1 indicates the abundant species of phytoplankters of the southeast United States shelf waters, found during one study in January, all of which may be found within the proposed lease area.

Total cell numbers decline in a seaward direction in the shelf waters ranging from 18,390 to 305,100 cells/liter nearshore while the range in the Gulf Stream is 4,530 to 8,030 cells/l. These variations can be accounted for by the fact that there is a distribution of salinity and nutrients in different areas of the shelf waters. There is a higher concentration of phytoplankton close to shore at 18 m (60 ft) depths due to an abundance of nitrate and phosphate. Beyond the 183 m (600 ft) contour line from Cape Hatteras to Florida where the nitrate and phosphate levels were negligible, a lower phytoplankton concentration was observed (Hulbert and MacKenzie, 1971). However, all of the proposed lease areas are in waters of less than 200 m and are all essentially west of the Gulf Stream. In areas where the shelf is wide, cell counts ranged from 75,000 to 750,000/L in shallow coastal stations, but were only 8,000 to 43,000/l in deeper stations.

Diatoms dominate the flora of the shelf waters. Marshall (1971) reported 100 diatom species throughout the study area with 86 species occurring during fall, winter and spring. Diatom cell numbers reached a maximum of 67,920/l over the shelf declining to 0 to 10 cells/l (36 species) in the Sargasso Sea. The dominant species of diatoms in shelf waters are: *Skeltonema costatum*, *Leptocylindrus danicus* and *Nitzschia seriata*. Other diatom species present include: *Chaetoceros decipiens*, *Navicula* sp., *Rhizosolenia alata*, *Thalassionema nitzschioides*, and *Rhizosolenia stolterfothii*.

The number of coccoliths increase in a seaward direction. *Coccolithys huxleyi* dominate the coccolith flora; other types include *Syracospheara mediterranea* and *S. pulchra*. *Coccolithys huxleyi* is absent close to shore from Virginia to Georgia, while the other species of phytoplankton compose the abundant populations in the shallow areas. Figure E-1 compares the locations and density for the total phytoplankton cell numbers and *Coccolithys Huxleyi* (Hulbert and MacKenzie, 1971).

Dinoflagellates were present during all seasons. They are important in the open sea in tropical water and in summer this group dominated the shelf flora. The major species for this area are *Amphidinum* sp., *Ceratium furea*, *C. fusus*, and *C. tripos*. *Gymnodinum* sp. is also present but is not present year round nor is it a dominant species. Marshall (1969) also found an unidentified dinoflagellate at nearly all depths to 300 m (984 ft) in the summer months. It reached a density of 3680/l and was a part of the dominant flora in shelf and Gulf Stream waters.

Productivity studies in coastal waters are limited. Thomas (1966) measured productivity in the shelf waters up to 25 km (15 mi) offshore from the Altamaha River and Sapelo Sound in Georgia using the C^{14} method. He observed an extremely high production of 547 g C/m^3/yr. Production was highest in August and lowest during the cooler months. Despite differences in run-off from the two estuaries, offshore productivity was equal for the two areas on an annual basis, but differed significantly during some months. In nearshore waters (less than 17 km (10 mi) offshore), productivity on a volume basis was maximal. However, on an areal basis, production was lower than further offshore. This results from the higher turbidity and shallower compensation depth of the nearshore waters. New productivity was positive at all stations since the critical depth exceeded the depth of the water column. Thus a trend toward increasing net production on an areal basis can be observed from just offshore (Ragotzkie, 1959) to further offshore waters (Thomas, 1966).

Thomas (1966) suggested that the seasonal differences in offshore productivity can be explained by the phosphate-poor river water pushing phosphate-rich estuarine water to an offshore lo-

Table E-1 - Abundant phytoplankton of the southeast United States shelf waters in January, 1968 (from Hulbert and MacKenzie, 1971).

Species	Area
Diatoms	
Nitzschia seriata	inshore
Bacteriastrum comosum	inshore
Asterionella japonica	inshore
Chaetoceros affinis	inshore
Skeletonema costatum	inshore
Chaetoceros decipiens	inshore
Leptocylindrus danicus	inshore
Rhizosolenia stolerfothii	inshore
Nitzschia closterium	inshore
Nitzschia delicatissim	inshore
Thalassionema nitzschioides	inshore
Coccolithopores	
Coccolithys huxleyi	widely dist.
Umbilicosphaera mirabilis	widely dist.
Calyptrospeaera oblonga	widely dist.
Chrytophyte	
Rhodomonas amphioxeia	inshore

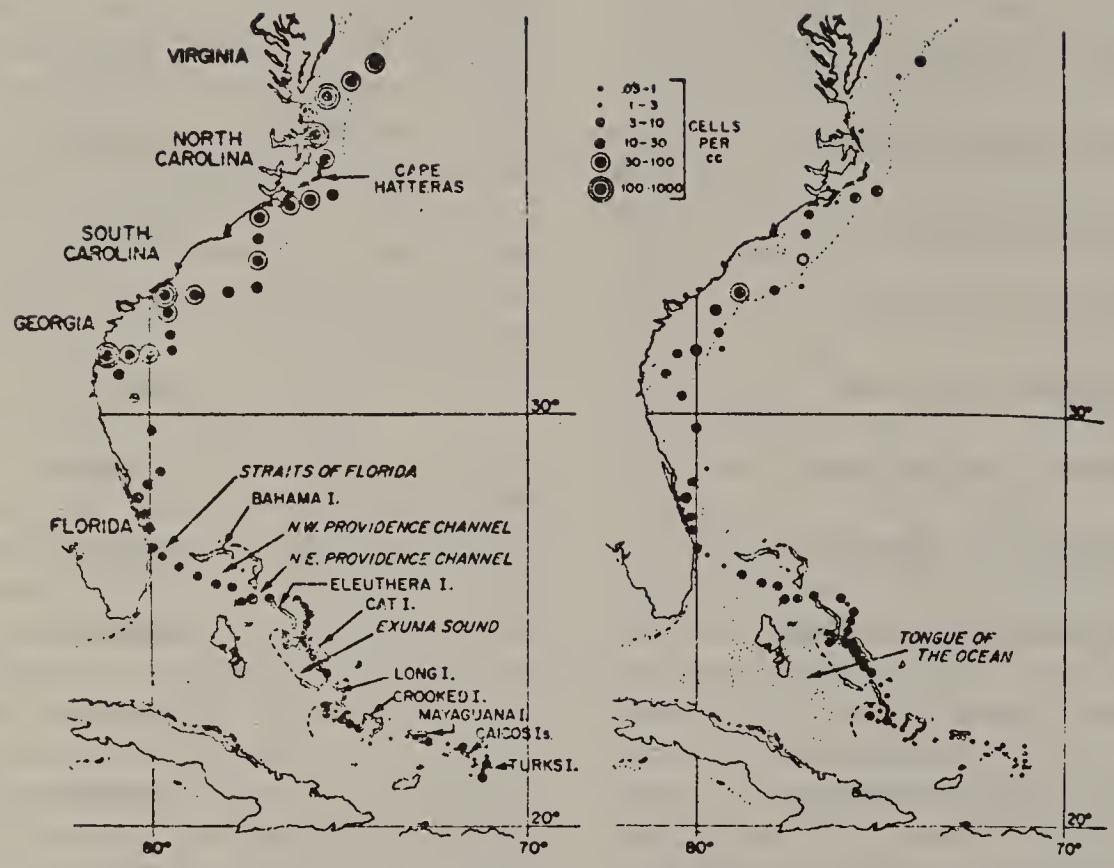


FIGURE E-1 Surface distribution of: left, total cell number; right *Coccolithus huxleyi*.

Source: Hulburt, Edward M. and R. S. Mackenzie. 1971. Distribution of Phytoplankton Species at the Western Margin of the North Atlantic Ocean. Bulletin of Marine Science. Vol. 21:603-612.

cation where increased transparency leads to high production even though the phytoplankton standing crop (measured as chlorophyll *a*) is low. Maximum productivity is limited to the summer months when river discharge is not so great to dilute the estuarine phosphate levels below stimulatory levels. High spring run-off dilutes the estuarines phosphate concentration, preventing the occurrence of a spring bloom.

A second study of productivity was reported for shelf waters (Thomas, 1971). Thomas studied a series of 21 stations during September ranging from Cape Fear to Cape Canaveral. Particulate organic matter (POM) and dissolved organic matter (DOM) ranged from 0.4 to 18.5 mg C/m^3/hr and 0.00 to 0.57 mg C/m^3/hr respectively. Released DOM was highly variable, ranging from 0 to 27%, but was usually less than 12.5%. An additional series of stations was studied in the Gulf Stream and Sargasso Sea of North Carolina in November. Release rates for DOM were generally higher in this region, reaching nearly 44%. Thus the release rate of DOM increases markedly in a seaward direction but is extremely variable in all zones.

Thomas (1971) also demonstrated that DOM release rates increase with depth. This must be considered in calculating integrated productivity rates even in coastal waters. This data cannot be converted to an annual basis from the information given, and hence cannot be directly compared to his earlier work (Thomas 1966). Information on coastal productivity throughout the region is inadequate and in need of further study.

B. ZOOPLANKTON

The zooplankton community of the southeastern U.S. continental shelf has not been extensively studied; however, Roberts (1974) summarized the available information for this area, the bulk of which comes from cruise reports and resultant papers based on collections conducted from the T. N. GILL, 1953-1954.

Bowman (1971) reported in detail on the copepods collected during the first four cruises of the T. N. GILL. He reported 100 species of copepods from these samples and compiled detailed distribution/abundance maps for each species collected.

There was a marked inshore-offshore zonation by species related to the water masses sampled (shelf water, Gulf Stream, and Sargasso Sea). The diversity of copepods increased in an offshore direction (10 species/sample near shore to 25 species/sample offshore), whereas copepod numbers decreased. There were no north-south trends observed.

Bowman (1971) computed affinity indices for the 13 species consistently present in significant numbers. From this data, he recognized three species associations related to inshore-offshore relationships (Table E-2). It should be noted that the proposed lease tracts are located in the "Shelf Water Mass". Of the remaining 81 species collected, most were oceanic. Despite the close affinity of copepod species with water masses, the degree of admixture of species from other masses is considerable, which is to be expected from the circulation patterns of these waters.

A few stations were dominated by coastal species, especially near the mouth of the St. Johns and Indian rivers (at Cape Canaveral), *Acartia tonsa* is dominant near Beaufort Inlet, St. Johns River and Cape Canaveral. *Labidocera aestiva* is more widely distributed in coastal and shelf waters.

The absence of a north-south variation in the copepod fauna results from the relative uniformity in temperature-salinity conditions along this axis. North of Cape Hatteras, the fauna is similar during warmer months when tropical species carried northward can find suitable conditions, but is clearly different during the cooler months. Species such as *Acartia tonsa* do occur in Virginia coastal water, but are increasingly limited to warmer months in northern areas and are replaced by *A. clausi* in colder months.

Pierce and Wass (1962) described in detail the chaetognath fauna from the T. N. GILL collections. They observed 12 species in three genera which is in agreement with the results of previous studies limited to the North Carolina coast (Bumpus and Pierce, 1955). The average density for the area was 8.7m^3 with individual species having average abundances ranging from 0.1 to 3.1/m . The dominant species based on abundance were different from those based on percent occurrence (Table E-3).

The abundance of chaetognaths in inshore areas was two to five times that of offshore areas, but species diversity increased. Table E-4 lists the 12 species and specifies the water masses with which they were associated. *Saggita hispida* was considered the best indicator of shelf waters, while *S.*

Table E-2 Copepod species associated by water mass (from Bowman, 1971)

Water Mass	Species
Coastal	Acartia tonsa
	Labidocera aestiva
Shelf	Paracalanus parvus
	Centropages furcatus
	Eucalanus pileatus
	Temora turbinata
Oceanic	Lucicutia flavicornis
	Temora stylifera
	Paracalanus aculeatus
	Clausocalanus furcatus
	Calanus minor
	Undinula vulgaris
	Euchaeta marina

Table E-3 Dominant species of chaetognaths based on abundance and based on percent occurrence (from Pierce and Wass, 1962)

Species	Percent Abundance 1/	Percent Occurrence 2/
Sagitta enflata	36.1	88.5
Sagitta tenuis	19.2	____
Sagitta helenae	15.4	50.5
Sagitta serratodentata	11.7	65.2
Krohnitta pacifica	____	60.2
Pterosagitta draco	____	54.4

1/ Percent of total individuals; species accounting for more than 10%.

2/ Percent of samples; species accounting for more than 50%.

Table E-4 Chaetognath species observed, and water mass(es) where each occurred (from Pierce and Wass, 1962).

Species	Water Mass
Sagitta enflata	Wide-spread
S. tenuis	Coastal
S. helenae	Shelf
S. serratodentata	Oceanic
S. hispida	Coastal
S. minima	Oceanic
S. pipunctata	Oceanic
S. hexaptera	Oceanic (deep water)
S. lyra	Oceanic (deep water)
Krohnitta pacifica	Wide-spread (but declined markedly in Sargasso Sea)
K. subtilis	Gulf Stream (rare)
Pterosagitta draco	Outer shelf and Gulf Stream

hexaptera, *S. lyra*, *Krohnitta pacifica* and *Pterosagitta draco* were the best indicators of Gulf Stream water. There was neither any north-south changes in distribution nor clear differences in seasonal distribution of these species, abundance changes were observed but could not be correlated with season.

The distribution of two pelagic decapods observed in the T. N. GILL collections (Bowman and McCain 1967), *Lucifer faxoni* and *L. typus*, has been described in detail. *L. faxoni* occurred over most of the sampled area, but were absent from the furthest offshore stations (Sargasso Sea). During the winter and spring months, *L. faxoni* was also absent from coastal stations. *L. typus* was found well offshore, usually seaward of the 200 m (656 ft.) contour. This species was closely associated with the Gulf Stream.

The pteropods have been identified from a collection that was limited to North Carolina waters (Chen and Hillman 1970). Nineteen species were found and can be grouped as subarctic (1 species), subtropical species, *Limacina retroversa* was found in cold slope waters (mainly north of Cape Hatteras) where it was dominant (97% of pteropods). The average abundance in this water mass was $15/m^3$. The subtropical group represented 10% of the pteropods in surface waters of the Gulf Stream (20-30% of the pteropods in the upper 200 m). The tropical species domintated the Gulf Stream waters with *L. trochiformis* representing 60% of the surface pteropod fauna (40% of the upper 200 m) and *Creceis virgula conica*, 21-36%. Pteropods were four times more abundant in slope water and seven times more abundant in the Sargasso Sea than in the Gulf Stream.

The only meroplanktonic group in the T. N. GILL collections which has been reported to date in a separate detailed publication is *Callinectes* larvae (not differentiated to species) (Nichols and Keney 1963). All eight zoeal stages and the megalopa were observed. They were most abundant in certain sections of the coast (Matanzas, Jacksonville, Savannah, Charleston and Cape Fear) which correlate with major sources of freshwater inflow. The largest numbers of early zoeal stages were found near the shore, with later stages found progressively further offshore. In Florida and Georgia waters, larvae were caught in every month (late stage larvae from April to October only) whereas in North and South Carolina waters early zoeae were observed from May to December, late zoeae from May to September, and megalopae year round. This correlates with the longer breeding season for *Callinectes* in southern waters, and suggests that these southern waters may be an important source of larvae for more northern waters. Other decapod larvae observed were listed (when identifiable) but no quantiative data were given.

Sutcliffe (1950) gives the percent occurrence for various zooplankters in North Carolinian waters (Table E-5). However, with the exception of copepods, chaetognaths and cladocerans, he did not distinguish between species. These data are somewhat misleading since seasonal differences in plankton composition are not considered. More meroplankters tend to be present in greater abundance during the warmer months and during these periods represent a larger fraction of the total zooplankton.

The zooplankton composition in cross categorizations was presented for each station sampled during the T. N. GILL cruises in the preliminary data reports, (Anderson et al. 1956a, 1956b and 1957; Anderson and Gehringer 1957, 1958a, 1958b, 1959a and 1959b). Data for cruises 5, 2, 7, and 8 have been selected to represent the situation during winter, spring, summer and fall, respectively.

The total concentration of surface zooplankton (numbers/m^3) tends to decrease with distance offshore. Relatively low concentrations observed were $3317/m^3$ off Cape Canaveral in the spring, $3499/m^3$ off Cape Romain in the summer and $3277/m^3$ off St. Augustine in the fall. During the winter the concentration was usually less than $1000/m^3$ except for three scattered stations.

In order to assess the zooplankton composition, raw data (numbers/m^3) for stations on four transects (Cape Hatteras, Cape Fear, Savannah and Cape Canaveral) were converted to percentages. The zooplankton was dominated in general by copepods and offshore, by larvaceans, both holoplankters. The degree of dominance at inshore stations was low during the spring, summer and fall when large numbers of meroplankton enter the fauna. Other holoplankters present include coelenterates (in part) and miscellaneous organisms (in part). Coelenterates and chaetognaths were increasingly important in the offshore plankton reaching eight percent. On rare occasions, high densities were also observed

Table E-5 Composition of the zooplankton off North Carolina (Sutcliffe, 1950)

Organisms	% Total Zooplankton
Copepodids	44.3
Copepod nauplii	41.2
Tunicate larvae, larvacea	5.1
Pelecypod larvae	3.6
Annelid larvae	2.3
Gastropod larvae	1.6
Chaetognaths	0.8
Medusae	0.2
Barnacle larvae	0.2
Echinoderm larvae	0.2
Pteropods	0.2
Cladocera	0.1
Pelagic tunicates	0.1

inshore. Euphausids were rare or absent on the inner shelf (1%) and usually one to three percent over the outer shelf and slope. Pteropods were slightly more abundant offshore, but nowhere exceeded two percent of the zooplankton. Miscellaneous crustaceans and the miscellaneous organisms category presumably contained some holoplankton (Lucifer sp., cladocera and rotifers), but their individual contribution to the total zooplankton has not been evaluated.

The meroplankton included coelentrates (in part), miscellaneous worms, shrimp, crabs, miscellaneous crustacea, molluscs, tunicates, lepticardii and other organisms. Miscellaneous worms were only a minor component of the zooplankton (1%) with no obvious seasonal or geographic trends. Shrimp were seasonally abundant (maximum of 15.79%) with greatest abundance on the inner shelf. Crabs (mostly larvae) were present during the spring, summer, and/or fall at different stations. Relative abundance over the outer shelf and slope was low (2%) and relatively uniform over the seasons. The maximum concentration (44%) occurred during the spring at the nearshore station on the Cape Fear Transect. On the Cape Hatteras transect, crabs were never more than 0.81% of the zooplankton even at the nearshore station. Miscellaneous molluscs (larvae) were seasonally abundant with a maximum of 11.3% during the fall at the nearshore station of the Savannah transect. This group was present year round, but generally less than two percent of the total zooplankton. Miscellaneous tunicates and lepticardii were minor components of the zooplankton with seasonal abundance peaks (summer or fall). Miscellaneous organisms sometimes dominated the nearshore (inner shelf) zooplankton (e.g. 59%, Cape Hatteras, nearshore station, spring; 34%, Cape Fear, inner shelf, fall; 77%, Cape Canaveral, nearshore station, fall).

Ichthyoplankton (fish eggs and larvae) were also enumerated. Eggs and larvae were present at all stations during all seasons with only a few exceptions. Fish eggs generally declined in abundance in an offshore direction. A maximum of 13% occurred over the outer shelf on the Cape Fear transect in the spring, and 10.9% nearshore on the outer shelf on the Cape Canaveral transect in the spring. Abundance of fish eggs seemed to increase slightly from north to south (not shown by the maxima), again suggesting that southern waters are a source of eggs and larvae for more northern waters. Seasonal abundance peaks occurred during the spring, summer, and/or fall, depending on the station. Fish larvae were always less than two percent, usually less than one percent of the total zooplankton, with no obvious seasonal or geographic trends.

St. John (1958) reported the zooplankton volumes for eight transects in North Carolina coastal shelf waters from Albemarle Sound to Cape Fear. The chaetognaths constituted 9 to 12% of the plankton volume in these samples. Maximum zooplankton volumes (m/m^3) occurred at stations located over the outer continental shelf, usually near the 40 m (131 ft.) depth contour (32 to 54 m). The average zooplankton volume in each transect ranged from 0.14 to 0.27 ml/m^3. The volume of plankton was relatively uniform regardless of season which supports the conclusion from enumerative data for the copepod and chaetognath species cited above.

Plankton volumes were also determined during the T. N. GILL cruises. Sampling sites for the plankton do not correspond to the standard stations and vary in number and location among the several cruises. The mean values of plankton for the inner shelf, outer shelf, and slope ranged from 0.045 to 0.431 ml/m^3. During each season, plankton volume was low over the inner shelf, increased over the outer shelf, and decreased over the slope. Closer examination of the data revealed a maximum plankton volume at stations located approximately between th 20 and 40 m (66-131 ft) depth contour, comparable to the results of St. John (1958). No north-south trend was evident except over the outer shelf during the winter cruise of 1954. In this case, the mean plankton volume was 0.210 ml/m^3 north of 33°, 0.652 ml/m^3 south of 33°.

The mean plankton volumes from the T. N. GILL cruises of 1954 and those of St. John (1958) for transects off the North Carolina coast are essentially the same, indicating that over the time span considered, plankton volumes were consistent.

Certain conclusions can be deduced from the available data. There is no major seasonal change in zooplankton community structure or abundance. The entire section of the coast is quite uniform from north to south with regard to species occurrence. In an onshore-offshore direction, there is a general increase in diversity but a

decrease in standing crop (expressed as numbers per liter and ml plankton per liter) with several water masses discernibly based on species composition: coastal water (strong admixture of estuarine water), shelf water, (possibly divisible into inner and outer shelf), Gulf Stream and Sargasso Sea.

c. BENTHOS

The dominant benthic species on the southeastern U.S. continental shelf region include cephalochordate amphioxus (*Branchiostoma caribaeum;*) polychaetes (*Spiophanes bombyx* and *Magelona* spp.); crustaceans (*Oxyurostylis smithi*, *Pinnixa chaetopterana* and *Callianassa* spp.); pelecypod (*Tellina* sp.) and ophiuroid (*Hemipholis elongata*).

Two major factors regulate benthic distribution on the continental shelf, sediment conditions and temperature. There is a relationship between the discontinuity of temperature and the distribution of chaetognaths and other benthic organisms.

Three subtidal sand bottom assemblages or zones were identified by Day et al. (1971): The turbulent zone, the outer continental shelf zone and the upper continental slope zone. The turbulent zone (from the surf zone to a depth of 20 m) is affected by a rippling wave action. The major species of this area include the sand dollar (*Mellita quinquiesperforata*), crabs (*Dissodactylus mellitae*), *the archiannelid* (*Polygordius*), the polychaete (*Maeroelymene zonalis*), the surf clam (*Spisula raveneli*) and the gastropod (*Olivella mutica*). These are all detritus feeders; however, a few filter-feeders (*Spisula* and *Branchiostoma*) also occur in this area (Table E-6). While none of the tracts of this proposed lease area are located shoreward of the 20 m isobath, the effects of oil and gas operations may be felt in this zone.

The outer continental shelf zone (40—120 m depth) is mainly affected by the Gulf Stream. Polychaetes represent the major taxonomic group in this area (Table E-7). The upper continental slope zone (160—205 m depth) is composed of the dead shells of pteropods and is the third assemblage. This zone is also dominated by polychaetes (Table E-8). All of the tracts of this proposed lease are within these two zones.

Off Beaufort Inlet, North Carolina, Bird (1970) studied the molluscan fauna. He identified some of the major species which include *Spisula raveneli*, *Lucina multilineata*, *Acteocina canaliculata*, *Crepidula convexa* and *Olivella mutica*. The South Carolina coast has a species composition similar to North Carolina.

Investigations have been carried out by Smith (1973) off Sapelo Island, Georgia. He found this area is dominated by polychaetes, molluscs and crustaceans. The dominant species in this area include *Notomatus* sp., *Spiophanes bombyx*, *Abra aequalis*, *Tellina texana*, *Oxyurostylis smithi*, *Callianassa* sp., and *Pinnixa caetopterana*. The echinoderms that dominate this area are *Hemipholis elongata*, *Micropholis atra* and *Mellita quinquiesperforta*.

Total community respiration ranged from 53.7 to 92.7 ml $0_2/m^2/hr$ (annual oxygen consumption was estimated at 676.6 l $0_2/m^2$. The contribution of the macrofauna respiration ranged from 5 to 26% of the total (based on the sum of individual measurements for each species in the community). Annual macrofaunal respiration equaled 82 $0_2/m^2$ which is equivalent to 397 kcal/m^2/yr. Bacterial respiration accounted for 30 to 60% of the total community respiration. In contrast, meiomicrofauna and microflora were estimated to be responsible for 25 to 58% of the total community respiration. Total community respiration and bacterial respiration were closely correlated with temperature and dissolved oxygen concentration, but respiration of the other components of the total community were not closely correlated.

The species were ranked by their contribution to total community respiration by season. The first five species for each season are listed in Table E-9. In general, these species also ranked high in numerical abundance and/or biomass for the same season. The exceptions to this general rule and the lack of exact correspondence in ranking, point out the potential danger of equating numerical or biomass dominance with functional studies (energy and material flow) and they are paramount to a complete understanding of communities and ultimate evaluation of the effect of man's activities on these communities.

Leiper (1973) analyzed the benthic fauna according to feeding types present. The proportion of detritus feeders in the faunal assemblages declines with distance offshore, while the proportion of suspension feeders increases. The differences are related to the availability of detritus derived from estuarine salt marshes. The sand bottom fauna is dominated by polychaetes, pelecypods, crustaceans (especially amphipods)

Table E-6 - Major Benthic Species of the Turbulent Zone (0-20 m) off North Carolina 100/sample

Species	Total Number of Organisms/Sample
Archiannelida	
Polygordius sp.	382
Polychaeta	
Palanotus heteroseta	116
Magelona papillicornis	229
Macroclymene zonalis	541
Amphipoda	
Platyischnopos n. sp.	102
Maera sp.	197
Echinodermata	
Mellita quinquiesperforata	1044
Gastropoda	
Olivella mutica	101

Source: Day, J. H. et al., 1971.

Table E-7 - Major Benthic Species of the Outer Continental Shelf (40-120 m) off North Carolina 100/Sample

Species	Total Number
Polychaeta	
Onuphius nebulosa	136
Chaetozone setosa	300
Amphipoda	
Siphonoecetes maculicornis	175

Source: Day et al., 1971.

Table E-8 - Major Benthic Species of the Upper Continental Shelf of North Carolina 100/Sample

Species	Total Number
Polychaeta	
Lumbrineris cruzensis	210
Scolaricia capensis	135
Chaetozone setosa	278
Notomastus latericeus	170
Amphipoda	
Unciola irrorata	187
Celecypoda	
Nucula delphinodonta	234

Source: Day et al., 1971.

Table E-9. Functionally dominant benthic species based on respiration by season of a sand bottom community off Sapelo Island, Georgia (from Smith, 1973).

Summer	
	Notomastus sp.
	Mellita quinquiesperforata
	Glycera dibranchiata
	Haliactus n. sp.
	Nephtys picta
Fall	
	Callianassa n. sp.
	Pinnixa chaetopterana
	Abra aequalis
	Micropholis atra
	Magelona sp.
Winter	
	Abra aequalis
	Notomastus sp.
	Callianassa n. sp.
	Micropholis atra
	Pinnixa chaetopterana
Spring	
	Abra aequalis
	Sabellides oculata
	Solen viridis
	Micropholis atra
	Tellina texana

Source: Smith, K. L., Sr., 1973.

and echinoderms. The seasonal variation of the benthos was also noted by Leiper.

Besides the sand bottom fauna, there are four other benthic assemblages in this area: calico scallop beds, coral outcroppings, a reef formed by ancient Lithothamnion deposits and "black rock reefs".

There are two calico scallop beds along the southeast Atlantic coast, one in Raleigh Bay, N.C., and another off Cape Canaveral (Cummins et al., 1962a). The dominant species are: *Argopectin gibbus* (calico scallops); *Balanus amphitrite* and *B. calidus* (barnacles); *Pomatoceros americanus*, *Sabellaria floridensis* and *Polydora websteri* (polychaetes (Table E-10). This assemblage is primarily dependent on plankton for its energy base.

Coral reefs are unknown in this area of assessment; however, outcropping of coral heads, sea fans and associated fauna have been reported from Onslow Bay, North Carolina, (Huntsman and Macintyre, 1971) and probably occur southward to Cape Canaveral. The reef-forming species that are dominant in this area include *Solenastrea hyades*, *Sidastrea siderea;* the non-reefing forming species are *Oculina arbuseula*, *Astrangia astreiformis*, *Phyllangia americana* and *Balanophyllia floriana* (Table E-10). This community is very important to commerical fishes and is known as the "live bottom area". McCloskey (1970) pointed out that this assemblage has an extremely high diversity when compared to assemblages from adjacent habitats. This is a result of the physical diversity of the coral heads.

Lithothamnion reefs have been identified seaward of the shelf break at the 80-110 m (262-361 ft) contour, approximately 76 km (47 mi) offshore from Onslow Bay, N.C. (Menzies et al., 1966). The reef fauna consists mainly of species associated with hard substances and/or epifaunal species, (Gray and Cerame-Vivas, 1966), and contains about 91% tropical species in composition. The upper sandy portion of this reef is dominated by the pelecypod, *Glycymeris* and an epifauna consisting of echinoids, gorgonians, hydroids and bryozoans. The low reef mud-sand assemblage is dominated by the gastropod, *Ploystira* and the brachyuran, *Acanthocarpus* (Table E-10). The food chain of this area is based on plankton and detritus.

The "Black Rock" reefs occur off North Carolina and are dominated by fossil pelecypods (*Venus gardneri*). The major species of this area are sessile snails, *Vermicularia spirata* and various tubicolous polychaetes. Corals are present but not in any significant amount. Other species present include boring clams (*Saxicava rugosa* and *Lithophaga bisulcata*) and sessil clams. Most species have a southern affinity.

D. NEKTON

Nekton are organisms which remain suspended in the water and whose power of locomotion are great enough to resist the set and drift of current, being subject only to large-scale physical forces. They are represented for offshore waters by five major taxonomic categories—marine mammals and reptiles, fishes, cephalopod molluscs (octopuses and squid) and certain crustaceans (shrimp and swimming crabs). Individuals of this group commonly but not always range over broad areas, thus they participate in several biotic communities. For example, shrimp have pelagic planktonic larvae, estuarine juvenile and pelagic or benthic adult stages. However, most nekton are limited in geographic and vertical ranges by the same environmental conditions as less mobile organisms; i.e., temperature, salinity, available food and types of bottom.

The following descriptions were taken mainly from Roberts (1974) and TRIGOM (1974).

The waters over the continental shelf of the South Atlantic region vary in their physical nature and resource potential (Struhsaker, 1969). The area inshore of approximately the 20 m (66 ft) depth is the area of the traditional fisheries for shrimp, crabs and the sciaenids. The bottom is generally smooth and sandy and the area undergoes large seasonal temperature fluctuations. Over most of the outer shelf 20 to 200 m (66-656 ft) the bottom is smooth and sandy to muddy. This area is directly influenced by the Gulf Stream, and bottom temperatures are often higher and more uniform seasonally than those inshore. This accounts for the occurrence of tropical fishes such as the snappers, groupers and porgies. Interspersed over the open shelf are areas of live-bottom habitat. These consist of rock outcroppings and reef formations that are heavily encrusted with sessile invertebrates such as sponges and sea fans. These usually occur at depths greater than 30 m (98 ft) but off the North Carolina coast they occur at depths as shallow as 18 m (59 ft). These are productive areas and sup-

Table E-10. Special Benthic Assemblages with Associated Major Species

Calico Scallop Area (Wells et al., 1964)	Scleratinian Coral Area (McCloskey, 1970)	Lithothamnion Reef Area (Menzies et al., 1966)
Balanus amphitrite	Coelenterata	Porifera
	Aiptasia eruptaurantia	
B. calidus		Coelenterata
	Nemertea	
Pomatoceros coerdus	*Nemertean sp. A*	Nemertea
Sabellaria floridensis	Annelida	Ectoprocta
	Polychaeta	
Websterinerus tridentata	*Autolytus prolifer*	Sipunculida
	Brania sp.	
Pinnotheres maculatus	*Eupomatus dianthus*	Echiuroidia
	Exogene sp	
Pontonia marginata	*Heteromastus filiformis*	Annelida
	Nereis occidentalis	
Odostomia seminuda	*N. succinea*	Mollusca
	Ophiodromus obscurus	
	Ploydora sp.	Arthropoda
	Sabellaria floridensis	
	Syllis cornuta	Echinodermata
	S. gracilis	
	Terebella rubra	Chordata
	Pelecypoda	
	Diplothyra smithi	
	Lithophaga aristata	
	L. bisulcata	
	Arthropoda	
	Copepoda	
	Parateutha n. sp.	
	Cirripedia	
	Balanus trigonus	
	Kochlorine floridana	
	Tanaidacea	
	Tanaid sp. A	
	T. sp. B	
	Isopoda	
	Jaeropsis coralicola	
	Erichthonius n. sp.	
	Gammaropsis maculatus	
	Lembos websteri	
	L. sp.	
	Leucothoe spinicarpa	
	Photis pugnator	
	Decapoda	
	Ophiothrix angulata	
	Echinodermata	
	Synalpheus frtizmuelleri	

port a handline fishery for snappers and groupers and a pot fishery for sea bass. On the lower shelf, below 120 m (394 ft), the substrate is predominantly smooth mud with relatively stable temperatures and a cold water-high-latitudinal fauna of hakes, flatfishes and butterfishes (Visuals Nos. 4N-S and 5N-S).

Nekton are generally categorized according to their principal mode of existence into the following categories:

(a) Pelagic—range widely throughout the water column, feeding on plankton and other fish such as squid, schooling fishes, marine mammals and cartilaginous fish.
(b) Demersal—associated with the bottom, feeding on bottom invertebrates and fishes and more restricted in their movements than pelagic species; for example, flounders, black sea bass, shrimp and swimming crabs.

Life history data for selected species of commercial and recreational finfish and shellfish for the South Atlantic were compiled by Roberts (1974). Additionally, Opresko et al. (1973) compiled life history data for lobsters and lobster-like animals and Voss et al. (1973) compiled data on octopus and squid. The total number of species considered in these data were: finfish 31, shellfish 12 and octopus and squid 7.

For additional information on nektic communities, please see Section II.E.1.e., Marine Mammals; II.E.2.c., Endangered Species; II.G.5., Commercial Fishery Resources; and II.G.6.d., Sport Fishing, and Visual Nos. 4N-S and 5N-S.

e. Marine mammals

The marine mammal fauna of the southeast Atlantic coast of the United States between Cape Hatteras, N.C. and Cape Canaveral, Fla., consists almost entirely of cetaceans (whales, dolphins and porpoises). However, two other groups, the pinnipeds (seals and sea lions) and sirenians (manatees) are also represented.

Caldwell and Caldwell (1974) summarized the data available on marine mammals in this region. Various checklists of North American mammals that include records of marine mammals from the study area include those of Caldwell and Golley (1965), Golley (1966), Caldwell et al. (1971), Moore (1953) and Layne (1965). Table E-11 indicates some of the marine mammal species that are located in the proposed lease area and identifies those which are considered endangered.

Because of this public interest, the U.S. Marine Mammal Protection Act of 1972 was established. This law provides for the protection of all marine mammals in the territorial waters of the United States (including marine mammal products imported into the United States). Although there is no commercial pressure on the pinnipeds and sirenians of the study area, they too are protected by the Act to the same degree as the cetaceans.

No species of marine mammal is restricted to this region, but a range extreme for some species does occur within the area. While not an absolute barrier, Cape Hatteras and/or Cape Canaveral tend to delineate ranges of a number of animal species, including some mobile marine mammals. The range limits are probably set more by oceanographic conditions than by the capes themselves. Most marine mammals are wide ranging and some are even world-wide in distribution, especially within a zoogeographic belt such as the tropics or temperate seas. The overall range of each marine mammal species is summarized by Rice and Scheffer (1968).

The population status of marine mammals in the western North Atlantic is relatively stable with a few exceptions such as the Sei Whale. There is a continual fluctuation in the numbers from time to time, but this could be due to less sighting of the animal rather than a decrease in population. There is no evidence to suggest that the fluctuations in food stock have affected the cetaceans, and weather plays a minor role in their population dynamics.

Within the study area, only three species of marine mammals can be said to utilize estuaries in a regular manner. These include the Atlantic bottlenosed dolphin, the Florida manatee, and the harbor seal. The California sea lion, is also found in estuaries in the study area, but it is an exogenous introduced species not known to breed in the western North Atlantic. The Atlantic bottlenose dolphin and the Florida manatee also enter freshwater rivers, creeks and springs. These species are probably the most vulnerable of all marine mammals to man's activities such as shoreline development, bottom disturbances of various kinds (dredging) and water sports. The hooded seal is a "natural" inhabitant of the area, and may be seasonally common as far south as North Carolina.

Some of the larger whales that occur in the study area are considered endangered (U.S. Dept. of Interior, 1975d). These whales are the black right whale, fin whale and the humpback whale are considered endangered. The Florida manatee is considered endangered (USDI, 1975d), and the

Table E-11 Species of Marine Mammals Known to Occur in the Region Between Cape Hatteras, N.C. and Cape Canaveral, Florida

Common Name	Scientific Name
* Black Right Whale	* Eugalena glacialis
* Humpback Whale	* Megaptera novaeangliae
* Sei Whale	* Balaeoptera acutorostrata
Bryde's Whale	B. edeni
* Fin Whale	* B. physalus
False killer whale	Pseudora crassidens
Killer Whale	Orcinus orca
Short-finned Pilot Whale	Globicephala macrorhyncha
* Sperm Whale	* Physeter catodon
Pygmy Killer Whale	Feresa attenuata
Pygmy Sperm Whale	Kogia breviceps
Dwarf Sperm Whale	K. simus
Antillean Beaked Whale	Mesoplodon europaeus
True's Beaked Whale	Mosoplodom mirus
Dense Beaked Whale	M. densirostris
Goose Beaked Whale	Ziphnus cavirostris
Rough-toothed Whale	Steno bredanensis
Risso's Dolphin	Grampus griseus
Saddleback Dolphin	Delphinus delphis
Bottlenose Dolphin	Tursiops truncatus
Spinner Dolphin	Stenella longirostris
Bridled Dolphin	S. frontalis
Spotted Dolphin	S. plagiodon
Harbor Porpoise	Phocoena phocoena
* Manatee West Indian (Florida)	Trichechus manatus
California Sea Lion	Zalophus californianus
Harbor Seal	Phoca vitulina concolor
Hooded Seal	Cystophora cristata

* Endangered Species

Source: Roberts, 1974. Dept. of Commerce, 1976.

species which includes this subspecies is listed as endangered by the international group (IUCN, 1972).

Many cetaceans found in the study area are considered rare, not only in this region, but also world-wide. Some of them are probably not rare but rather only infrequently encountered by man. The pygmy sperm whale and the goosebeaked whale have long been termed as rare species, but recent evidence (greater observational effort) suggests that they are not as uncommon as once believed.

The Florida manatee population is increasing in Florida. The range of the manatee extends to South Carolina. The major area where these animals congregate are in warm waters. It is believed that manatees migrate offshore and avoid the extremely shallow flats and waterways near coastal inlets. They travel through the complex of sand bars, oyster reefs and limestone shelves (Hartman, 1969). The primary food source of the Florida manatee is aquatic vegetation.

The majority of the population now survive in the coastal waterways of Florida. The main enemy of the Florida manatee is man's activities. Many animals are lost each year as a result of increased use of waterways by commercial ships and pleasure boats. Their slow rate of reproduction, one calf per adult female every three years, has severely handicapped the population. Those that survive are left with scarred backs from wounds inflicted by the propellers on boats.

Further work is being conducted regarding population densities and habitat of manatees at the University of Miami, and FWS in Gainesville, Fla.

F. PELAGIC BIRDS

Wass (1974) summarized available data pertaining to pelagic birds species in the southeast and north Atlantic (Table E-12). The general order of abundance of pelagic birds along the southeast U.S. coast is as follows: petrells, shearwaters, gannets, phalaropes, jaegers and terns. Many of these species migrate annually through the area. However, a significant number are located offshore and also use the southeast Atlantic states for nesting purposes (Visual Nos. 5N-S). Pelagic bird rookeries are found in Pamlico Sound and Cape Fear, North Carolina; the entire Georgia coast; and in the vicinity of Cape Canaveral, Florida. Brown pelican rookeries have been observed in Pamlico Sound, North Carolina; Bulls Bay and Seabrook Island, South Carolina; near Daytona Beach, Vero Beach, and Ft. Pierce, Florida. Both terns and pelicans have rookeries at the Cape Romain Migratory Bird Refuge. Stragglers from the north include the skua, alcids and northern gulls, terns, boobies, tropicbirds and frigatebirds migrate from the south.

Two groups of migratory pelagic birds are identifiable, based on definite patterns of movement. The first group exhibits a southward movement in fall and a return movement the next spring. The bird most often seen in this group is the gannet, which winters north to Massachusetts, but is often seen in greatest numbers in the Carolinas, and less often in Florida. Juveniles of this species move further south. Gannets usually stay well offshore, except when strong "northeasters" occur.

Two shorebirds which exhibit this migratory pattern are the northern and red phalaropes. However, they move south earlier, continuing into the tropics, and return from April to June inclusive. They also tend to stray offshore. Red phalaropes appear off North Carolina in mid-August. Northern phalaropes appear about a month later off North Carolina, and off Florida during October. Although the northern phalarope is said in general to be the more abundant of the two, it occurs in smaller concentrations off the southeastern U.S. coast.

The pelagic group also includes the skuas and three species of jaegers. The largest movement of these birds along the southeastern U.S. coast was reported by Buckley (1973). He recorded 47 jaegers during seven hours of counting from May 30 to June 1, 1972. These included 11 pomarine, 26 parasitic, and 10 long-tailed jaegers and 2 skuas.

The sooty shearwater usually migrates somewhat earlier than the other shearwaters. Shearwaters, especially the greater, have occasionally suffered mass die-offs in the last decade. In Britain, die-offs have been attributed to PCB's. However, along Virginia, North Carolina, and Georgia the cause of the die-offs have not been studied. Nevertheless, shearwaters are perhaps one of the most abundant pelagic birds.

The second group of migratory pelagic birds is more truly oceanic in that most of the group breed on islands in the south Atlantic and migrate annually in a great circle around the north Atlan-

Table E-12. Pelagic Birds Occurring in the Southeastern North Atlantic Region.

Stercorarius pomorinus	Pomarine Jaeger
S. parasiticus	Parasitic Jaeger
S. longicaudus	Long-tailed Jaeger
Larus hyperboreus	Glaucus Gull
L. glaucoides	Iceland Gull
L. marinus	Great Black-backed Gull
L. fuscus	Lesser Black-backed Gull
L. argentatus	Herring Gull
L. delawarensis	Ring-billed Gull
L. ridibundus	Black-headed Gull
L. atricilla	Laughing Gull
L. philadelphia	Bonaparte's Gull
L. minutus	Little Gull
Rissa tridcatyla	Black-legged Kittiwake
Xema sabini	Sabine's Gull
Gelochelidon nilotica	Gull-billed Tern
Sterna forsteri	Forster's Tern
S. hirundo	Common Tern
S. paradisaea	Arctic Tern
S. dougallii	Roseate Tern
S. anaethetus	Bridled Tern
S. fuscata	Sooty Tern
S. albifrons	Least Tern
Aiious stolidus	Noddy Tern
Thalasseus maximum	Royal Tern
T. sandvicensis	Sandwich Tern
Hydroprogne caspia	Caspian Tern
Chlidonias niger	Black Tern
C. leucopterus	White-winged Black Tern
Rynchops nigra	Black Skimmer
Alca Torda	Razorbill
Uria lomvia	Thick-billed Murre
Plautus alle	Dovekie
Cepphus grylle	Black Guillemot
Fratercula arctica	Common Puffin

Source: Wass, 1974.

tic. Because of its wide-spread dispersal, the Wilson's storm petrel, whose numbers typically exceed those of all other pelagic species combined for most of May to September off the southeastern U.S. coast, is most notable. This "sea swallow" nests on islands of the Antarctic Ocean and even in Antarctic. It moves up the Atlantic coast during March through August, crosses the ocean on the North Atlantic Drift, turns south along Europe, reaches the equator by mid-October and its breeding grounds about mid-November.

Wilson's storm petrel is the best known pelagic bird, and its concentrations are exceeded by those of migrating shearwaters. Such large flocks pass Cape Hatteras that in six hours of observation (during two evenings) Buckley (1973) estimated 10,000 shearwaters (half being Cory's, one-fourth greater and one-fourth sooty). In addition, Manx shearwaters were seen, a record for the coast south of Long Island. The latter species nests mainly in the eastern Atlantic, but has recently nested off Massachusetts. The shearwaters seen in the southeastern U.S. coastal region mostly nest in the South Atlantic. Four species of terns occur offshore, the Arctic tern being the most frequent. The bridled, sooty, and noody tern are tropical and occasionally straggle north over the Gulf stream.

G. LIVE BOTTOM AREAS

The southeastern continental shelf of the U.S. contains areas commonly referred to as "live bottoms". These areas are defined as containing biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans and hard corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography; and whose lithotope favors accumulation of turtles, pelagic and demersal fish, (Visuals No. 4N and 4S). Other names given to these areas are hard bottoms, coral patches, fishing banks, snapper banks, block rocks and limestone or "lithothamnion" reefs. These areas support a major finfish fisheries (commercial and recreational) on the South Atlantic OCS in addition to artificial reefs. Those type bottom-fisheries associated with these areas include porgies (*Calamus* and *Pagrus*), groupers (*Epinephelus* and *Mycteroperca*), snappers (*Lutjanus* and *Rhomboplites*), and grunts (*Haemulon*) (Huntsman, 1976).

Except for "Sapelo Live Bottom" or Gray's Reef and the Onslow Bay coral patches, little is known about the location, size and ecology of these live bottom areas. Underwater television of certain live bottoms indicate that they are very "patchy" or localized in character which makes accurate areal description, based on existing data, impossible.

Huntsman (1976) described two types of headboats in North and South Carolina that fish along the live bottom areas. (1) those that fish near inshore rocks and coral patches from 27 to 46 m (15 to 25 fath) (inshore boats) and (2) those that fish the shelf break zone and the extreme outer shelf from 46 m to 73 m (25 to 80 fath) (offshore boats). Roller trawling has recently been introduced in these areas and is known to cause some damage to the live bottom habitat. However, the temporal and spatial extent of the damage is not well known at present and is the subject of some controversey (National Fisherman, 1976).

In Georgia, live bottom areas are likely to be found in the following areas: 16 m to 24 m (9 to 13 fath) depth contour; the 31 m to 39 m (17 to 21 fath) depth contour; and the 110 m to 165 m (60 to 90 fath) depth contour. The shelf break off Georgia occurs at 150 m (82 fath) (Harding, 1976).

Lastly, Moe (1963, 1970) delineated certain areas off the east coast of Florida as containing live bottom areas but he did not limit areas according to depth contours.

Specific locations and descriptions of live bottom ("hard bottom") areas or where concentrations of porgies, groupers, and snapper were caught have been reported by Bearden and McKenzie (1973), Bullis and Thompson (1965), Ogren (1975), Harrington and Rivers (1975), Huntsman and Macintyre (1971), Radcliffe (1914), Struhsaker (1969), Scott and Huntsman (1976), Jacksonville Offshore Sport Fishing Club (1973), Smith (1975), Hutsman (1976), Barans (1975), Newton, Pilkey, and Blanton (1971), North Carolina Department of Conservation and Development (1969), Macintyre (1969), Harding (1976) and Macintyre and Pilkey (1969). While only 5% of the proposed lease tracts have specifically reported live bottoms in them, it is clear from Visual No. 4S that these areas lie in a general North-South trend just shoreward of the 200 m isobath, and that the proposed lease tracts lie more or less astride this trend. Thus it is likely

that more of these important fishing areas will be discovered during the exploratory phase of oil and gas development, and measures to protect them will have to be taken.

Relief for these areas varies significantly with the shelf break having probably the greatest vertical relief in the proposed lease area. Topography for the shelf break consists primarily of undulating sand and sand ridges broken by ridges, troughs, ledges, and terraces varying from minimal (less than 1 m) to 15 + m for certain ridges (Macintyre and Milliman, 1970). "Rufus Reef" at 155 m (85 fath.) off Savannah, Ga. has a relief of 11 m (6 fath.) (Harding, 1976). The same type of minimal relief can also be expected for the inner and intermediate shelf areas with the greatest vertical relief being approximately 7 m (6.6 m was reported by Hunt (1974) for Gray's Reef).

The following narration describes those areas in which scientific investigations have been conducted.

(1) Shelf break

The shelf break from Cape Hatteras to Cape Canaveral is probably the most significant undersea feature in the study area. The following description was taken from Macintyre and Milliman (1970):

> The topography near the shelf break of the continental margin off the southeastern U.S. is highly variable, but for summary purposes may be divided into four distinct areas, each having characteristic morphologies and lithologies: (a) Cape Hatteras to Cape Fear, (b) Cape Fear to Cape Kennedy, (c) Cape Kennedy to Palm Beach, and (d) Palm Beach to Fort Lauderdale. Each area is subdivided into topographic zones, and plots of representative profiles within each zone are shown in Figures E-2, E-3 and E-4.

Cape Hatteras to Cape Fear: For a distance of about 300 km off North Carolina between Cape Hatteras and Cape Fear (zones A to J, Fig. E-2), ridges, troughs and terraces (depths of 50 to 150 m) parallel the shelf break (50 to 80 m), but here and there give way to a smooth, undulating sea floor (zones C and I). Although there is a little depth correlation between features throughout this area, terraces and ridge bases between Cape Lookout and Cape Fear occur in a depth range of 90 to 110 m (zones F to J). These ridges do not have relief of more than 15 m above the trough directly shoreward of them, and they do not rise above the general over-all slope of the sea floor, except possibly in zones A and E.

Bottom photographs of the outer shelf edge and upper slope in this area show the sea floor to be composed mainly of rock fragments (<64 mm), gravel (2 to 64 mm), and shell hash, all in a sand matrix. Knobby rock surfaces or poorly defined rock ledges commonly protrude through the sediment cover on the upper slopes above the ridges, troughs, and terraces.

Algal limestone, sandstone, and shell hash constitute the material collected in rock dredges from the Cape Hatteras to Cape Fear area, and although all three components were present both above and below the shelf break, more algal limestone was recovered from the ridges and terraces, whereas sandstone was more abundant on the slope above the ridges or terraces, and on the outer shelf edge.

Sediments on the outer shelf off North Carolina are rich in carbonate (generally greater than 50%) and are dominated by coralline algae, barnacles, and mollusk fragments, corresponding in composition to the coralline algal and barnacle assemblage described by Milliamn et al., (1968). In the immediate vicinity of the ridges, algal fragments tend to be crustose; leeward the fragments become increasingly branching. Oolite sediments are found locally. Seaward of the ridges, the slope sediments are characterized by increasing amounts of planktonic foraminifera.

Cape Fear to Cape Kennedy (Cape Canaveral): From Cape Fear (33°25'N) to an area just north of Cape Kennedy (29°15'N), the sea floor at the outer shelf and upper slope is mainly smooth and undulating, and the shelf break generally indistinct. Wherever there is no marked change in slope between depths of 60 to 80 m, the minor change in slope between depths of 40 to 50 m is taken to be the shelf break. The K profiles (Figs E-2 and E-3) illustrate typical bathymetric transects of this area. Ledges, small terraces, and slight rises are present here and there near the shelf break in depths of 50 to 110 m, but no depth correlation was established between these features. The terraces occur at depths of 70 to 110 m, whereas the ledges (6 to 10 m relief) are in depths of 50 to 70 m. Rises commonly established on the edge of the ledges generally have relief of less than five meters.

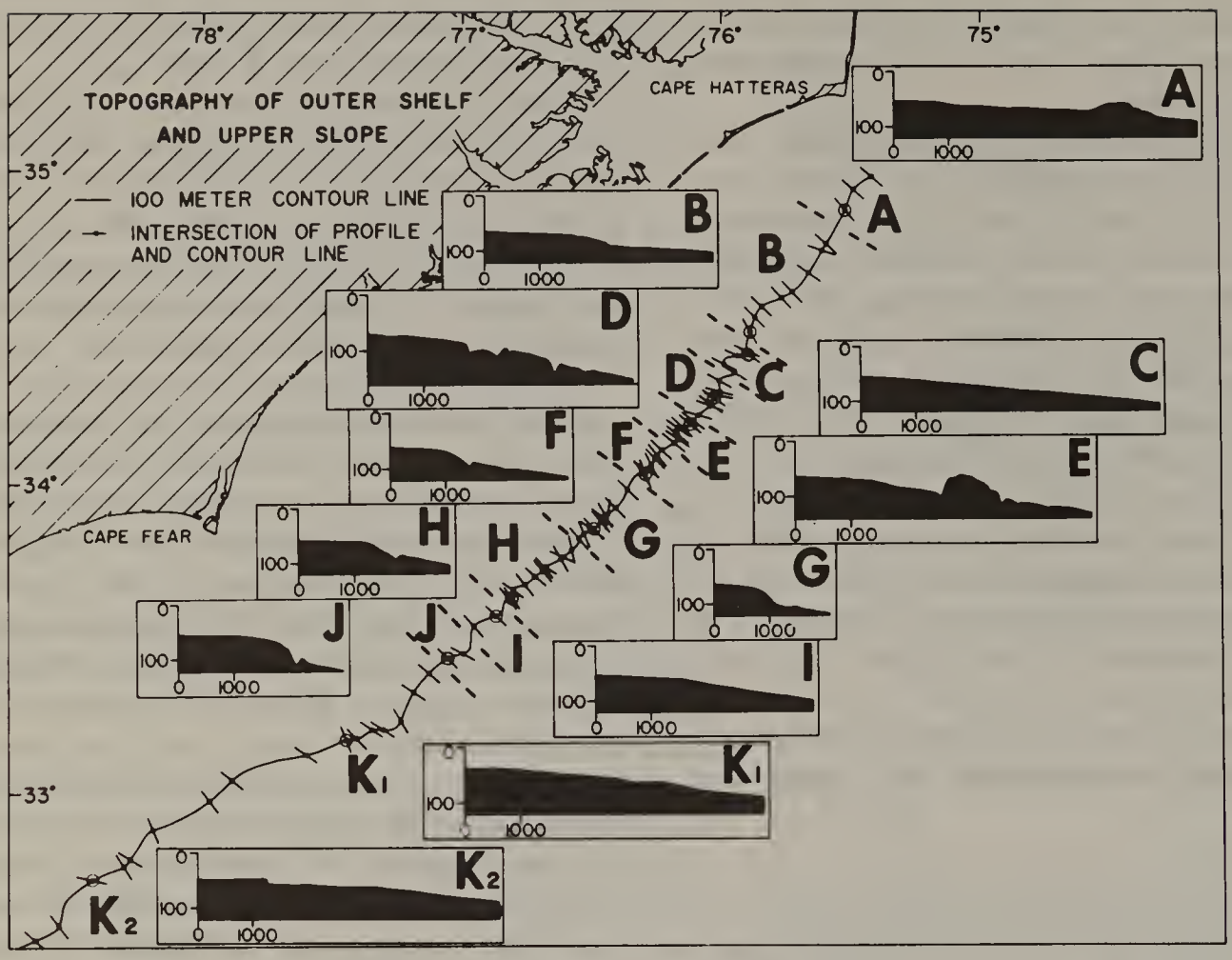


FIGURE E-2

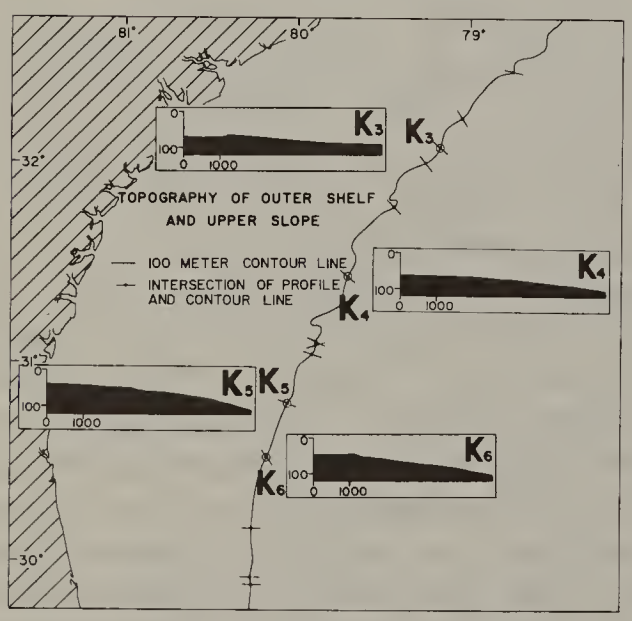


FIGURE E-3

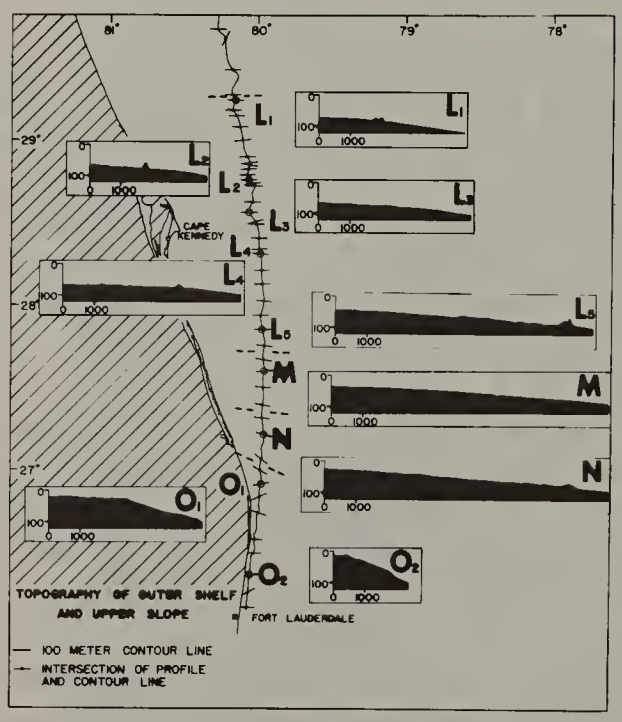


FIGURE E-4

Source: Macintyre and Milliman, 1970.

Bottom photographs from around the shelf break show mainly gravel and shell has scattered in or partly covered by a sand mud matrix. Small rock fragments are evident in a few photographs, and rough rock ledges covered by rich epifaunal growths are exposed locally (Fig. E-4); large clusters of the coral *Oculina* sp. are common off northern Florida. As in the area off North Carolina, the abundance of burrows, mounds, and trails indicates considerable infaunal activity in this area of the sea floor.

Rock-dredge samples generally are similar to those taken between Cape Hatteras and Cape Fear: algal limestone, quartz-rich calcarenite, calcareous quartz sandstone, and shell hash were collected from ledges and small rises at the shelf break. The noncarbonate fraction of the sandstones, however, is significantly higher than in the sandstones north of this area, averaging about 50% and ranging from 24 to 72% in the samples studied. The carbonate mineralogy is very similar to that of rock from the area north; both the algal limestone (average 73% MgCl) and the sandstones (average 64% MgCl) are rich in magnesium calcite and have lessor amounts of aragonite and calcite).

Sediments from this area are relatively rich in terrigenous material derived from Piedmont rivers in the neighboring coastal areas; carbonate values rarely exceed 40% (Milliman, 1972). Off South Carolina and Georgia, the carbonate components are dominated by coralline algae and barnacles in similar proportions to the sediments found farther north. On the outer shelf off southern Georgia and northern Florida, oolite becomes a dominant component, and algal fragments are less important (Pilkey et al., 1966; Milliman, 1972).

(2) Coral patches

Coral reefs are unknown from the study area but rock outcrops supporting epifaunal communities of coral heads, sea fans and associated fauna have been reported from Onslow Bay, N.C. (Macintyre and Pilkey, 1969; Huntsman and Macintyre, 1971) and probably occur southward to Cape Canaveral out to 40 m (see Figure E-5). The coral consist of reef-forming species, *Solenastrea hyades* and *Sidastrea siderea*, and the non-reef forming species, *Oculina arbuscula*, *Astrangia astreiformis*, *Phyllangia americana*, and *Balanophyllia floridana* (Macintyre, 1970), Huntsman and Macintyre (1971) list various fish species collected near the coral outcroppings. This community is very important to commercial fishes and motile invertebrates as a food source. This is known as "live bottom habitat" by fisheries scientists as are many other areas. The tropical reef corals have not been reported in water depths of less than 20 m off North Carolina however, non-reefbuilding species are common in these colder turbid waters.

The faunal assemblage associated with the coral, *Oculina arbuscula*, at four sites was described by McCloskey (1970). He examined samples from three shallow water sites, Cape Lookout jetty, Sharkshoal jetty (both near Beaufort, N.C.) and Charleston, S.C., north jetty, and one deep water site, the Cape Lookout outcrop (ca. 10 m). A total of 309 species was reported. Although basically similar, assemblages differed in detail between various sampling sites. The shallow water assemblages showed higher diversity than the deep water assemblage, contrary to expectation based on the greater variability of obvious physical factors (salinity, temperature, etc.) in shallow water which generally result in low diversity. McCloskey (1970) suggested that sand scouring is the dominant physical parameter on Cape Lookout outcrop, which explains the distribution of diversity. Increased scouring or sediment loads can be expected to adversely affect this community.

Polychaetes and molluscs are represented by the greatest number of species (89 and 74 respectively). From these lists it can be seen that many species occurred as dominants at several stations, but the fact that their relative ranking in the samples differed is not shown, implying differences in the structure of the assemblages.

McCloskey (1970) pointed out that this assemblage in the broad sense has an extremely high diversity compared to assemblages from adjacent habitats. He believes that the high diversity results from physical diversity of the coral heads.

The vast majority of the dominant species are deposit feeders, with a number of filter feeders and carnivores also dominant. Detritus may well be significant in the diet of the filter feeders as well as the deposit feeders.

(3) Black rock reefs

Pearse and Williams (1951) described the fauna associated with the so-called "black rock" reefs off the Carolinas. These rock out-crops consist of a base of Trent marl dominated by a fossil pelecypoda (*Venus gardneri*). Some 300 species



Figure E-5. This is a photograph taken 40 km (25 miles) off Onslow Bay, North Carolina in a 30.5 m (100 ft) of water. This particular reefal area is approximately 4.6 km (3.5 miles) long by .8 km (.5 mi) wide. To date 73 species of fishes have been identified from this reef. Preliminary estimates indicate these North Carolina reefs support twice the standing crop that a tropical reef has.

Some of the fishes in the picture are:

gag grouper - *Mycteroperca microlepis*
purple reeffish - *Chromis scotti*
blue anelfish - *Holacanthus bermudensis*
twospot cardinal fish - *Apogon pseudomaculatus*
slippery deck - *Halichoeres bivittatus*
Spanish hogfish - *Bodianus rufus*
rock beauty - *Holancanthus tricolor*

are listed (including associated fish fauna). The chief species contributing to building of the reefs are the sessile snail, *Vernicularia spirata*, and various tubicolous polychaetes. Corals are present but do not contribute significantly to the relief of these structures, according to Pearse. Boring clams (*Saxicava rugosa* and *Lithophaga bisulcata*) and sessile clams are conspicuous members of the assemblage. Most species have a southern affinity.

(*4*) *Gray's Reef*—("*Sapelo Live Bottom*").

Hunt (1974) described the geology and origin of Gray's Reef which is also known as Sapelo Live Bottom. It is located in about 19.8 m of water approximately 33 km due east of Sapelo Island, Ga. (see Figure E-6. The reef substrate is a layer of rock composed of a moderately to strongly dolomitized, sandy biomicrite which occurs as an outcropping layer. The reef itself is heavily encrusted by sessile benthos (sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, and hard corals) and serves as a valuable habitat for snappers, groupers, porgies, tropical fish, and other associated motile reefal species (Hunt, 1974 and Smith, 1975). The total vertical relief in the area is 6.6 m. This reef is not in the proposed lease area.

2. Coastal and Onshore

A. VEGETATION

The upland vegetation biome characteristic of the entire southeastern United States, exclusive of the southern portion of the Florida peninsula, is classified as Southeastern Evergreen Forest. This biome begins in southeastern Virginia, south of the James River, and is restricted to the coastal plain throughout its range.

Numerous major river systems dissect the southeast. Low, broad floodplains are particularly characteristic of the rivers in the southeastern evergreen forest. The largest bottomlands occur along the major rivers and represent some of the most natural country remaining in the southeast due to their general inaccessibility.

The southeastern evergreen forest contains several community types which are treated by several authors. Waggoner (1975), Roberts et al. (1974), U.S. Dept. of the Army (173a, 1973b), USDA (1969), Hedlund and Janssen (1963), and Braun (1950) have detailed the vegetative profile for the southeastern region of the country. Mapped vegetative data are depicted from available sources on Visual Nos. 4N-s.

The following discussion on the community types characteristic of the southeastern evergreen forests is a brief summary of a more detailed treatment of Waggoner (1975).

Coastal plain upland hardwood forests: are primarily climax communities that exist in three phases (dry, intermediate and rich) depending on the soil conditions. The dominant species are comprised mostly of oaks (*Quercus* spp.) with other common hardwoods (beech, gum, hickory, etc.) becoming increasingly prevalent in the rich phase of this forest type.

Upland pine forests: these communities are successional in nature and are dominated by an overstory of pines with the understory comprised of oak species. Three phases also occur in this type that are determined by edaphic conditions.

The Florida scrub phase is restricted to Florida and is totally dominated by sand pine (*Pinus clausa*). The sandhills phase occurs wherever there are areas of moderate, deep sand deposits. Dominant vegetative composition consists of an overstory of longleaf pine with a scrubby inventory usually consisting of turkey oak (*Quercus laevis*). The loblolly pine—shortleaf pine phase occurs on disturbed upland habitats. As the name implies, loblolly pine (*Pinus taeda*) and shortleaf pine (*Pinus echinata*) dominate the various areas of this type. Several species of hardwoods may comprise the understory.

(*Pine flatwoods:* are the dominant vegetation type over this southeastern U.S. coastal region. The vast expanse of primarily longleaf pine (*Pinus palustris*) forest over the relatively level coastal plain are largely responsible for the name "southeastern evergreen forest" region. Depending on the particular habitat within this type, longleaf pine dominates the drier soils, slash pine (*Pinus ellcitti*) dominates the wetter flatwoods and pond pine (*Pinus serotina*) is predominate in the wet flatwoods which have a pH < 4.5.

Cypress-gum swamp forests: are one of the most characteristic communities of the southeastern evergreen forest and occur along many of the major rivers. In the deeper swamps, baldcypress (*Taxodium distichum*) and/or water tupelo (*Nyssa aquatica*) exist without associates. This community represents the least disturbed area in the southeast.

Bottomland hardwood forests: are one of the most diverse in vegetative types in the southwest and occupy the floodplains on the major rivers.



Figure E-6. This is a photograph of Gray's reef off Sapelo Island, Georgia. This is representative of the live bottoms off the Georgia coast. The black seabass *Centropristis striata* is a common inhabitant of these live bottoms but in the photograph its abundance is atypical. Usually, there are many more individuals.

Several species comprise this community. Depending on the location, species of maple, cottonwood, hickory oak, beech, elm and many others comprise the vegetative composition. The cypress-gum swamplands and bottomland hardwood forest together comprise the freshwater forrested wetland system.

Evergreen shrub bog: this community type occurs in the lower coastal plain in areas of low water energy. It is usually characterized by an open canopy of pond pine or loblolly bay. The dominant understory species include sweet, red and loblolly bay. Other shrubby species include fetter bush, sweet galfberry, zenobia, leatherleaf and other species with tropical affinities.

Maritime forest: this community type occurs on the outer fringe of the coastal plain adjacent to the ocean. It occurs on the mainland and/or offshore islands and banks. Live oak (*Quercus virginiana*) is the most characteristic species of this community, and typical species associated with this type include red cedar (*Juniperus virginiana*), ironwood (*Carponus caroliniana*), red mulberry (*Morus rubra*) and wild olive (*Osmanthus americana*).

Savanna: this community type has on the most diverse floras of any community in this region. These areas result from continuing annual burning of pine flatwoods. Longleaf pine and/or slash pine occur in very open strands or they may be entirely absent. Species of bald cypress are present in the innundated areas. An unparalleled variety of forbs and grasses comprise the majority of the vegetation.

B. WILDLIFE

(1) Birds

There are approximately 400 different species of birds found between Cape Hatteras, N.C. and Cape Canaveral, Fla. Approximately 60% of the birds which occur along the coast are dependent on various aquatic habitat during parts of the year.

Most oceanic species dive into the water to catch their prey, (gannets and pelicans) while some species feed on surface plankton, (petrels and phalaropes). All these birds require water which is clear enough to see their prey.

Isolated islands, spoil banks and remote or protected beaches are especially valuable habitats for ground nesting sea birds. Other ground nesting species utilize dunes, marshes and washovers.

There are several sources for abundance data, the U.S. Fish and Wildlife Service surveys and the Christmas Bird Counts (CBC's) made by the Audubon Society. The most common birds found during CBC's made in the coastal counties of South Atlantic States are found in Table E-13. Florida is responsible for most of the high totals, while North Carolina is second indicates the presence of excellent habitats as well as better coverage in those states. Only the Ringbilled Gull, Mourning Dove and Fish Crow are somewhat evenly distributed among the four states. Since the 1930's a greater interest in preserving the bird species of a particular area became evident. Early conservation methods were headed by the Audubon Society and resulted in saving egrets, pelicans and some other birds until refuges, laws and enforcement were adequate. Coastal refuges such as Cedar Isle Wildlife Refuge and Pung Wildlife Refuge, North Carolina have been acquired and sportsmen have aided this effort by purchasing Duck Stamps. Banding and winter censuses were also expanded by the Fish and Wildlife Service.

Diving Birds

This group includes loons, grebes, pelicans and cormorants. The Brown pelican is the most important of this group. This species is considered endangered and nests in large colonies. It is rarely found north of Ocracoke, North Carolina. Their primary food source is fish for which they dive.

Pelagic Birds

The general abundance of pelagic birds along the southeast coast is petrels, shearwaters, gannets, phalaropes, jaegers and terns. These species migrate through the area annually. There are two groups of pelagic birds that are identified by their patterns of movement. The first group exhibits a southward movement in the fall and returns in the spring, it is represented by the gannet and phalaropes. The second group is oceanic in that they breed on islands in the South Atlantic and migrate in great circles around the North Atlantic annually. Two species which are representative of this group are migrating shearwaters and Wilson's storm petrel. The shearwaters migrate in such masses that Buckley (1973) estimated over 10,000 during a six hour observation period at Cape Hatteras, N.C.

Table E-13. Most common winter birds (area 10). Based on Christmas bird counts for the coastal counties of the four southeastern states, 1972-1973.

	North Carolina		South Carolina		Georgia		Florida		Total Area	
Species	Total Count	Rank	Total Count	Rank	Total Count	Rank	Total Count	Rank	Total Count	Rank
Snow Goose	6,000	4	---		---		1		6,000	
Pintail	3,920	6	30		10		2,400		6,360	
Green-winged Teal	3,100	10	210		5		640		3,955	
Wigeon	340		1040	7	215		3,130		4,725	
Wood Duck	80		70		355		10		515	
Lesser Scaup	90		1090	5	100		65,770	2	67,050	4
Red-breasted Merganser	3,450	8	30		55		256		3,790	
American Coot	1,200		820	9	250		84,120	1	86,390	1
Dunlin	3,580	7	1210	3	500	9	900		6,190	10
Herring Gull	14,200	1	580		890	5	3,880	10	19,550	6
Ring-billed Gull	12,380	2	765		2250	1	8,770	6	24,165	5
Black Skimmer	170		3		1090	3	4,150	9	5,415	
Mourning Dove	300		775		445	10	530		2,050	
Tree Swallow	165		15		125		11,455	5	11,760	8
Blue Jay	200		1385	2	640	7	835		3,065	
Fish Crow	530		380		205		5,500	8	6,615	9
Robin	5,600	5	1100	4	605	8	63,575	3	70,875	3
Yellow-rumped Warbler	8,500	3	1000	8	2145	2	63,100	4	74,745	2
Red-winged Blackbird	3,240	9	3660	1	870	6	5,910	7	13,680	7
Boat-tailed Grackle	800		1060	6	910	4	2,140		4,910	
Common Grackle	70		985	8	290		1,480		2,825	
Dark-eyed Junco	320		770	10	10		4		1,100	

Source: Audubon Society, 1974.

Waterfowl

This group includes swans, geese and ducks. They spend a considerable portion of their life on various water bodies on which they depend for much of their food supply.

The Whistling Swan has been known to winter in Pamlico Sound, North Carolina. These species feed on aquatic and marsh plants; any disruption or loss of this habitat could be detrimental to the population. The Canadian Goose has also increased its population by establishing new breeding grounds. The development of wildlife refuges and its ability to feed on agricultural crops has allowed the population to remain stable.

The common species of ducks include dabbling ducks, pochards and sea ducks. The dabbling ducks are represented by the Mallard and Black Duck. These species are the most common hunted species as a result the population has been decreasing (Ferguson and Smith, 1974). The pochards include four common diving ducks in the study area, Canvasback, Redhead, Lesser Scaups and Ringed-Necked Duck. The Lesser Scaups winter in Florida and probably outnumber all other ducks in the area. The Canvasback and redhead also winter along the east coast. A large number of Redheads are found at Merritt Island, Fla. These birds usually breed in the northern regions in the summer and migrate to the warmer climates in the winter.

Sea ducks include species such as the Common scoter which is the most common species south of Cape Hatteras. Only six to seven percent of the Atlantic Flyway is inhabited by sea ducks.

Wading Birds

This group includes herons, bitterns, ibises and egrets whose habitat is freshwater areas and saltwater bays. These birds, particularly the larger ones, are quite euryphagous. In areas where they occupy large heronries, they recycle considerable amounts of organic matter and associated nutrients from the water to swamps and lands. The population of species such as the Night Heron, Green Heron and White Ibis have decreased in this area, while the egrets and Great Blue Heron have increased.

Shorebirds

Of the 44 species that occur in the study area only three are confined to nesting mainly in the eastern U.S., the American Oystercatcher, American Woodcock and Wilson's Plover. The habitat range for these species is marsh lands (American Woodcock), dunes and high beaches in Beaufort, N.C. (Wilson's & Piping Plover). Both are suffering a decline in population that can be attributed to man's encroachment.

Birds of Prey

The three predatory species which formerly impacted most heavily on coastal ecology are the Bald Eagle, Osprey and Peregrine Falcon all of which hunt mainly over saline water in estuaries and nearshore. At present the Bald Eagle has only been found to nest in South Carolina and Florida. The reduction of the Bald Eagle in Florida seems mainly due to development which has destroyed most of the tall longleaf pines. The Osprey is also found nesting in North and South Carolina where there is a substantial number of sites (Table E-14).

The Peregrine Falcon has not nested in the wild in the eastern limited states for over a decade. The reduction of this species is basically due to their poisoning by pesticides.

Vultures, kites and owls are the other predators that nest along the South Atlantic coast. Two species of vultures occur in the study area, the Turkey Vulture which occurs along the coast and the Black Vulture which feeds on fish and young birds from heronries. These species have been on the decline because of better animal husbandry and fewer animal carrion.

Four species of kites occur within the region, Shallow-tailed, Mississippi Everglades and White-tailed Kites. The first two breed in South Carolina, Georgia and Florida. Of these birds only the Mississippi Kite which breeds along the Gulf Coast is increasing in population.

Owls constitute the largest group of terrestrial predators. The only common species in the study area are the Screech, Great-Horned and Barred Owl. Their numbers have been declining in the last decade.

Upland Game Birds

There are six species in this category found on the coastal plains. The Bobwhite, the only eastern quail, is the most intensely hunted bird in North America. It is among the most common species in Georgia. The turkey is found throughout the area and especially on Jekyll Island, Georgia where it is protected. The Chachalaca was introduced to Georgia barrier islands and still exists on Sapelo Island. The Mourning Dove is also intensely hunted in the south. Development probably has

Table E-14. Representative species of the Southeast Atlantic Bird Populations

Common Name	Scientific Name	Habitat	Primary Food	Population Trend
Birds of Prey				
* Bald eagle	*Haliacetus levcocephalus	freshwater areas	ducks, rodents, rabbits	declining
Osprey	Pandion haliaetus	coastal bays and estuaries	fish	declining
* Peregrine falcon	*Falco peregrinus	coastal and mountainous areas	small birds	breeding pop. existent
Limpkin	Aramus guaraua	freshwater marshes	mullusks & crustaceans	decreasing
American Coot	Fulicia americana	estuaries and bays	omnivorous	decreasing
Shorebirds				
American oyster catcher	Haematopus ralliatus	marine coasts, tidal zones and beaches	oyster	increasing
Piping plover	Charadrius melodus	lake shores and sandy marine beaches	crustaceans & marine animals	decreasing
Wilson's plover	Charadrius wilsonia	beaches, sand bars, mud flats & inlets	small mollusks and shrimp	decreasing
Seabirds				
Great black-beaked gull	Larus marinus	beaches, harbors and garbage dumps	fish	increasing
Ring-billed gull	Larus delawarensis	lakes, seacoasts, and estuaries	insects, rodents, eggs	decreasing
Gull-billed tern	Gelochelidon nilotica	seacoasts and marshes	insectivorous	decreasing
Forster's tern	Sterna forsteri	fresh & saltwater marshes	fish & aquatic organisms	stable
Least tern	Sterna albifrons	mud, sand & gravel beaches of estuaries and oceans	small fish	increasing
Black Skimmer	Rhynchops nigra	ocean coasta, lagoons and barren sands	fish & crustaceans	decreasing

Table E-14 (continued)

Common Name	Scientific Name	Habitat	Primary Food	Population Trend
Belted kingfisher	Megaceryle alcyon	fresh water and salt-water shores	fish	stable
*Dusky seaside sparrow	*Ammospiza nigrescens	salt marshes	insects	decreasing
Open Water Birds				
Common loon	Gavia immer	saltwater-winter, freshwater-summer	fish	stable
*Brown pelican	*Pelecannus occidentalis	inshore saltwater bays, sandy beaches	menhaden	stable
Water Turkey	Anhinga anhing	swamp and slow moving fresh & saltwater	fish & aquatic veg.	decreasing
Wading Birds				
Great blue heron	Ardea herodias	tree tops(nest) feed salt & freshwater	fish	stable
Green heron	Butorides virescens	fresh and saltwater	small fish	decreasing
Little blue heron	Florida caerulea	fresh and salt marshes, meadows	small fish and crustaceans	increasing
Cattle egret	Bubulcus ibis	nest in brachish areas	orthopterous insects	increasing
Wood Stock	Mycteria americana	fresh & brackish water	small fish	decreasing
Glossy ibis	Plegadis falcinellus	marshes - saltwater & fresh	crayfish & insects	increasing
White ibis	Eudocimus albus	brackish & freshwater marshes	crustaceans	stable
Waterfowl				
Wood duck	Aix sponsa	ponds, swamps & rivers	oak, hickory & duckweed	decreasing
Redhead	Myroca americana	freshwater & estuaries	aquatic roots & bulbs	increasing
Canvasback	Aythya valisineria	prairie potholes & freshwater	aquatic vegetation	decreasing
Lesser Scaup	Aythya affinis	saltwater bays and estuaries	plants	decreasing
Red-breasted merganser	Mergus serrator	freshwater-summer & saltwater-winter	fish	decreasing

* Endangered
Source: Roberts, 1974.

benefited this species especially in Florida where large areas have been off limits to hunting. The Rock Dove or "pigeon" is the most urban bird and is found in metropolitan areas.

Cranes, Limpkins, Rails and Coots

The Florida Sandhill Crane is a subspecies that is found to breed in considerable numbers in Florida and Georgia. The Limpkin is another species that is known only to breed in the Florida swamps. These populations are presently surviving due to the establishment of refuge areas.

The Clapper Rail is another species that inhabits salt marshes along the southeastern coast. Coastal development has posed a problem for the clapper since it migrates at night and becomes confused by the city and highway lights.

One of the most abundant Florida wintering birds is the American Coot. This species depends on marsh habitat.

Gulls, Terns and Skimmers

Gulls are primarily cold water birds while terns prefer warmer climes. There are five gulls found within the study area, The Laughing, Herring, Black-beaked, Ringbilled and Bonaparte's Gull. The Ringbilled is the most common along the east coast. Fourteen terns have been recorded along the southeast coast but only two were found to nest in great abundance the Least and Gull-billed Terns. The Gull-billed Tern has been found to nest in abundance at Cape Romain, however, as a result of severe storms much of their nesting sites have been destroyed. Foster's Tern are abundant during the winter in Florida and North Carolina. The Black Skimmer is another species that nests along the southeast coast using tern nests for their broods. These species are also decreasing due to the severe storms.

The Belted Kingfisher nests along the east coast on stable banks in which it tunnels a hole for its nest and requires open water for feeding.

Cuckoo's are also represented along the east coast by the Yellow-billed and Black-billed cuckoo which nest in deciduous forests. These are valuable birds because they consume catepillars. Goatsuckers are another group of birds which Chuck's-will-widow is a common species throughout coniferous forest, including maritime forest and salt marshes (Frenduburg and De Poe, 1958).

The Ruby-throated Hummingbird is the only species that breeds along the east coast. The Red-cockaded Woodpecker which is on the endangered list occurs over most of the southeast in pine forests.

(2) *Other wildlife*

Wildlife species in the southeastern U.S. coastal region are as diversified as the numerous habitat types that occur in this region. Many of these species are ubiquitous, while others are more selective in their habitat preferences, and others still may be endemic to a particular region. Several data sources are available concerning specific vertebrate fauna of the region. Conant (1958) lists 113 species or subspecies of herptofauna that occur in this region; mammals are treated by Burt and Grossenheider (1964), and fifty-one species or subspecies of mammals are recorded as occurring in this region. Parnell and Adams (1970) detailed the upland faunal components of a typical island off the coast of North Carolina. This island appears to be representative of islands existing offshore from the southeastern U.S. states. Neuhauser and Baker (1974) and Hillestad (1974) provide accounts of species representative of habitat types in the southeastern states. The purpose of this section will be to briefly identify some of the more common species which characterize some of the habitat types found in this region. Freshwater fish species are also discussed in this section. Endangered species are discussed in Section II.E.2.c. and approximate habitats are illustrated on Visuals Nos. 5N and 5S.

The Department of the Army (1973a and 1973b) discusses various species typical of the habitat types in North and South Carolina. Much of the following discussion on upland habitats was taken from these sources.

The upland hardwood of the oak-hickory type provide food cover and a good, wide-ranging habitat for wildlife, particularly the gray squirrel, southern flying squirrel, black bear, and white-tailed deer. Mast from oak, hickory, walnut, beech, gum, wildgrape, dogwood, persimmon and other trees and shrubs provide ample food. Hardwood forests also provide tree dens for squirrels and raccoons and trunk dens for big animals, like the black bear. Extremely dense, mature hardwood stands are not particularly well suited to deer populations because the growth of understory vegetation which provides browse is restricted by overstory shading.

In comparison to hardwood forests, mature pine stands furnish a smaller variety and quantity of food, and tree dens are less frequent and adequate. Animals of the coniferous forests are usually more food specific and also more tolerant of the dense cover conditions than those animals associated with hardwood forests.

Characteristic species of this community are dominated by rodents, small carnivores and various reptiles and amphibians. White-tailed deer are common in upland forests, though not as abundant as in the more open forested areas.

Small game animals and fur animals are in general abundance, being represented by marsh rabbits, squirrels, opossums, raccoons, foxes, muskrats, minks and otters. Beaver colonies are established in some river sections. Larger animals include deer and bobcat. Alligators, an endangered species, are an important inhabitant of the riverine ecosystem. Although this narrative focuses on the high density riverine areas, it should be recognized that these animals are found in all wetland habitats.

Considerable fishery data are available from stream surveys for the southeastern U.S. region. For the purpose of this statement, these surveys are considered to be representative transects which adequately depict the fish fauna of this region.

Several reports are available from North Carolina. Smith and Bayless (1964) surveyed and classified the Tar River and its tributaries. The total fish population of this watershed included 20 families and 75 species with the sunfishes (centrarchidae) as the dominant family. Eleven species of game fish were prevalent in this survey. These included the redfin and chain pickerel, largemouth, striped and Roanoke bass, flier, warmouth, redbreast sunfish, pumpkinseed, bluegill and black crappie.

Louder (1962) surveyed the Lumber and Shallotte rivers and found similar results. However, species diversity was less evident with only 46 species being accounted for. Typical non-game fishes observed in this survey included the golden and ironcolor shiner, lake chubsucker, yellow bullhead and the American eel. Ratledge, et al. (1966) also compiled a checklist of fishes for the lotic waters of North Carolina.

Curtis (1970 and 1971) conducted anadromous fish surveys of the Combahee, Santee and Cooper rivers of South Carolina. In the Combahee watershed, sunfishes were dominant representing a total of 15 species out of the total of 67 species recorded. Numerous species of shiners, catfishes and darters were also evident. Species in the Santee River did not deviate significantly from the species recorded in the Combahee. However, several marine species were collected in the Cooper in addition to the freshwater species. An unpublished checklist lists species collected in a Savannah River survey. Sixteen species of minnow and carp and 14 species of sunfish accounted for about 41% of the composition of 72 species.

Dahlberg et al. (1971) summarized data and provided an annotated checklist of the freshwater fishes of Georgia. A total of 209 species and 22 families comprised the freshwater fish fauna that was dominated by 67 species of minnow and carp. In addition, there were 25 species of sunfish and 39 species from the perch families. However, only 38 species are restricted to the coastal plain of Georgia.

An unpublished checklist from the Florida Game and Freshwater Fish Commission lists fish fauna occurring in freshwater sources in the Atlantic coastal plain of Florida. The species listed were comparable to those previously discussed states.

c. Endangered species

The Bureau of Land Management maintains frequent contact with FWS and NMFS in meeting its responsibilities under Section 7 of the Endangered Species Act. Also resource reports are requested from FWS and NMFS prior to the preparation of each environmental statement and liaison is maintained during the review process of each EIS, S.O. 2974 consultations and preparation of environmental stipulations.

The Fish and Wildlife Service has designated a critical habitat for the American Crocodile and Florida Manatee (September 24, 1976), 41 FR 41914-41916). The notice pertaining to critical habitat was published on April 22, 1975 (40 FR 17764-17765). This notice stated that "Critical Habitat" for any Endangered or Threatened species could be the entire habitat or any portion thereof, if, and only if, any constituent element is necessary to the normal needs or survival of that species. The following vital needs are relevant in determining "critical habitat" for a given species:

(1) Space for normal growth, movements, or territorial behavior;
(2) Nutritional requirements, such as food, water, minerals;
(3) Sites for breeding, reproduction, or rearing of offspring;

(4) Cover or shelter, or
(5) Other biological, physical, or behavioral requirements.

Several federally designated endangered species occur, either on a permanent or on a transitional basis, within the geographic area being assessed for this proposed sale. With many of these no definitive range is identified, thus it is difficult to portray the species accurately for environmental assessment purposes.

Table E-15 lists the federally endangered species that occur in this analysis area. In lieu of attempting to depict all of these on Visual Nos. 5N-S, a brief description of the habitat and range of all the species will follow.

Short-nosed sturgeon: This species is confined to the lower sections of larger rivers and in coastal marine habitats primarily from southern New Brunswick to extreme northeastern Florida, however, it rarely occurs south of central South Carolina and its occurrence in Florida is based on a single account from the St. Johns River. However, it has been reported in the Altamaha River, Georgia, as well. Also, shad fishermen have reported catching this species.

Brown pelican: This species breeds and lives on the Atlantic coast from North Carolina to Florida, Visual Nos. 5N-S. This species nests in large colonies on sandy beaches and in trees and shrubs along the southeastern United States. They feed mainly on menhaden and other fish. Since the establishment of refuges and law enforcement and the decreased use of DDT, this species appears now to have a chance to increase its population.

Southern bald eagle: The primary breeding population of eagles for this analysis area is located in Florida and South Carolina (Visual Nos. 5N-S). The other south Atlantic states report transitional eagles. Reduction of the bald eagle in Florida is mainly due to heavy use of pesticides and to development which has destroyed the longleaf pine which are used as nesting sites. The bald eagle is primarily riparian, associated with the coast or with lake and river shores, and feeds on rodents, ducks, coots, rabbits, and fish.

Dusky seaside sparrow: This species is restricted to Brevard County, Florida (Visual No. 5S). Primary habitat is cordgrass (*Spartina bakerii*) marses and wet savannahs on the slightly brackish St. Johns floodplain.

Alligator: The alligator in this geographic area occurs from North Carolina to the southern tip of Florida. It occurs primarily in the fresh water environment (rivers, swamps, bogs, etc.) from the coastal area inland.

The alligator has been reclassified as a threatened species in all of Florida and in certain coastal areas of Georgia, Louisiana, South Carolina and Texas (43 FR 2071-2077; 1/10/77).

American Crocodile: occurs mainly in Southern Florida, in the fresh water environment from the coastal area inland. The Fish and Wildlife Service Laboratory at Gainsville, Florida is performing intensive research on the biology of the endangered American crocodile.

Peregrine falcon: The occurrence of this species in the assessment area results mainly from migrating individuals. However, Florida serves as an important wintering habitat. The primary migration routes are located along the high energy beaches of the south Atlantic states. This species formerly bred south to north Georgia, but although the breeding sites remain along the east coast, the birds do not utilize them. However, it is very likely that breeding the Peregrine falcon will again be established if a population increase can be effected. Sites such as Tallulah, George, among others, still exhibit all the criteria for falcon nesting sites.

Eskimo curlew:

Ivory-billed woodpecker:

Everglade kite: This subspecies of kite occurring in the United States is confined strictly to Florida (Visual No. 5N). Kites require freshwater marshes with a distant horizon and low vegetative profiles. Almost permanent flooding of the marsh is needed to sustain an adequate food supply which is exclusively the freshwater Apple Snail.

Bachman's warbler: The species in this area is known only from recent observations near Charleston and Francis Marion National Forest in South Carolina. However, its habitat of river swamp forests does not preclude it from occurring in other areas within the assessment region.

Red-cockaded woodpecker: The geographic distribution of this woodpecker is primarily coastal plain pinewoods in the southeastern United States. Presently, South Carolina, Georgia and Florida are believed to have the highest populations. This species is associated exclusively with mature to overmature southern pines. Historically, longleaf pine has been the most utilized with loblolly, shortleaf, slash and pond pine used with varying degrees of frequency.

Table E-15. Endangered Species Occurring in the U.S. South Atlantic Region.

Common Name	Scientific Name
Short-nosed sturgeon	*Acipenser brevirostrum*
Leatherback turtle	*Dermochelys coriacea*
Hawksbill turtle	*Eretmochelys imbricata*
Atlantic ridley	*Lepidochelys kempii*
American alligator	*Alligator mississipiensis*
*Brown pelican	*Pelacanus occidentalis*
*Southern bald eagle	*Haliaeetus levcocephalus*
*Everglades kite	*Rostuhamus sociabilis plumbeus*
Peregrine falcon	*Falco peregrinus*
Eskimo curlew	*Numenius borealis*
Ivory-billed woodpecker	*Campephilus principalis*
*Red-cockaded woodpecker	*Dendrocopus borealis*
*Dusky seaside sparrow	*Ammospiza maritima nigrescens*
Bachman's warbler	*Vermivora bachmanii*
Florida panther	*Felis concolor coryi*
Eastern cougar	*Felis concolor cougar*
Humpback whale	*Megaptera novaeangliae*
Right whale	*Eubalaena spp.*
Sei whale	*Balaenoptera borealis*
Blue whale	*Balaenoptera musculus*
Finback whale	*Balaenoptere physalus*
Sperm whale	*Physeter catodon*
West Indian manatee	*Trichechus manatus*

*Depicted on Visual 5N-S.

Eastern cougar: There does not appear to be a definite range reported for the cougar in this area of assessment. Several credible observations from the Carolinas indicate that it does occur in this region through the population is probably small and widely dispersed.

Florida panther: The Florida panther is primarily restricted to Florida though recent sightings suggest that the species may occur in parts of Georgia. Large, unmolested habitats that support abundant deer populations favor the panther.

Sea turtles: These species are inclusive of those listed in Table E-15 plus the loggerhead and green sea turtles which are currently proposed for a classification of "threatened" under the U.S. Fish and Wildlife Service criteria. The areas of concern in the analysis area are the high energy beaches occurring along the south Atlantic which the turtles utilize for nesting (Visual Nos. 5N-S).

Humpback whale: This species is considered stable in the study area. These whales move through, or adjacent to, the lease area on their northward and southward migrations. The primary food source is krill and shoaling fish.

Right whale: The population status of this species is stable to increasing in the southeast Atlantic. The appearance of the right whale is seasonal. These animals migrate northward from January to March moving close to shore, and their southward movement is believed to occur offshore in the fall. The primary food sources is zooplankton—copepods.

Sei whale: The records for southeast Atlantic sightings are too sparse to make a judgement concerning population. The migration pattern of the sei whale is southward during colder months and northward during warmer months.

Blue Whale:

Finback whale:

Sperm whale: The population of this species is considered stable. The migrate route is northward during the spring and summer and southward during the fall. Their primary food source is squid.

West Indian manatee: Recent data has revealed a greater range on the Atlantic coast than was previously known, the range extends to South Carolina. These animals congregate in warm waters and they seek open water to travel along well established corridors through the complex of sand bars, oyster reefs, and limestone shelves (Hartman, 1969). The majority of the population now survive in isolated pockets in Florida. Their primary food source is aquatic vegetation. The Fish and Wildlife Service Laboratory at Gainsville, Florida is performing intensive research on the biology of the endangered West Indian manatee.

F. Biological Environments of the Coastal Zone

1. High Energy Beaches

A. INTERTIDAL

High energy beach is the predominant front shoreline type in the South Atlantic planning area and is quartz dominated south to Cape Canaveral where it becomes calcareous in nature. The inventoried ocean shoreline in this reach consists of 1,918 km of which 1,575 km are considered high energy beach (U.S. Army, 1971b). The sand grain sizes are self-organizing in dependence on the energy of the waves. Surging waters are received, filtered and returned to the sea. Characteristic beach fauna participate within the massive sand medium in the process of filtering organic matter. The beach line provides organization to passing water masses and supports many reproductive cycles in which eggs are deposited at the beach. The characteristic longshore current supports many migrations.

This special ecosystem, with its shifting sands and pounding waves, includes a very specialized biota, the sand dwellers or psammon. Some of the sand fauna are found entirely below the water line, some high on the beach, and some at the drift line where organic rubbish accumulates. The epipsammon (shore-birds, fishes, certain beetles, etc.) live on the sand surface; the endopsammon (snails, bivalves, crustacea, etc.) burrow beneath the surface; and the mesopsammon (diatoms, ciliates, tardigrades, turbellarians, gastrotrichs, gnathostomulids, copepods, etc.) live between the sand grains. The beach with its sand fauna forms an extensive food filtering system which takes nutrients from the inrushing water in the form of detritus, possibly dissolved materials, and planktonic or larger organisms.

Some of the macrofauna of Southeastern U.S. sand beaches are shown in Figure F-1. Interstitial fauna are shown in Figures F-2 and F-3. Special locomotory, respiratory and morphological adaptations permit the psammon to inhabit a shifting environment that may be alternately flooded and exposed to desiccation, where oxygen tension may be low, and where waves beat ceaselessly.

Especially characteristic of high energy beaches in the South Atlantic area are the pelecypod, *Donax variabilis*, and the mole crab, (*Emerita talpoida*). Both are adapted for rapid burrowing in the loose sands at the tide line. They have been shown to migrate up and down the beach in response to wave action (Pearse et al., 1942; Turner and Belding, 1957). Both species are filter-feeders. Several species with permanent burrows also occur in the lower intertidal or subtidal area, including several crustaceans (*Callianassa major* and *Lepidopa websteri* and polychaetes (especially *Scolelepis squamata*). These forms are also filter-feeders. Numerically dominant are various haustoriid amphipods which are interstitial filter-feeding species. In the upper portion of the intertidal zone, amphipods of the genus *Talorchestia* (beach hoppers) are frequently dominant, feeding on organic detritus (algal and grass fragments) cast up by the waves (Reid and McMahan, 1974).

Carnivores are typically more mobile and include marine animals that follow the rising tide (silversides, killifish, flounders, lizard fish, crabs and creeping starfish) and terrestrial predators that feed on the exposed beach at low tide (Pearse et al., 1942).

Among those birds which feed on mollusks, crustaceans, and other invertebrates at low tide are the American oyster-catcher, semipalmated plover, pipping plover, Wilson's plover, black-bellied plover, ruddy turnstone, willet, American knot, least sandpiper, semipalmated sandpiper, western sandpiper, and sanderling. Several species feed below and in the intertidal zone on small fish. These include common terns, least terns, royal terns and black skimmers. Herring gulls, ring-billed gulls, black vultures, and fish crows are common scavengers of the beach and dune areas. Formerly, the bald eagle was a commonly observed scavenger along the beach (Johnson et al., 1974).

In the spring and early summer, horseshoe crabs (*Limulus polyphemus*) appear on the beaches in large numbers to breed and lay their eggs. Late in the summer tiny crabs may be seen on the beach sand at low tide. The breeding and reproductive stage of the life cycle is the only time horseshoe crabs come ashore. Both the young and adult crabs normally feed in the bottom habitat of shallow waters. Some of the largest individuals of the species have been reported from the Georgia coast (Shuster, 1955 and Johnson et al., 1974).

B. UPPER BEACH AND DUNES

The area of the beach above the high-tide mark is inhabited or frequented primarily by organisms

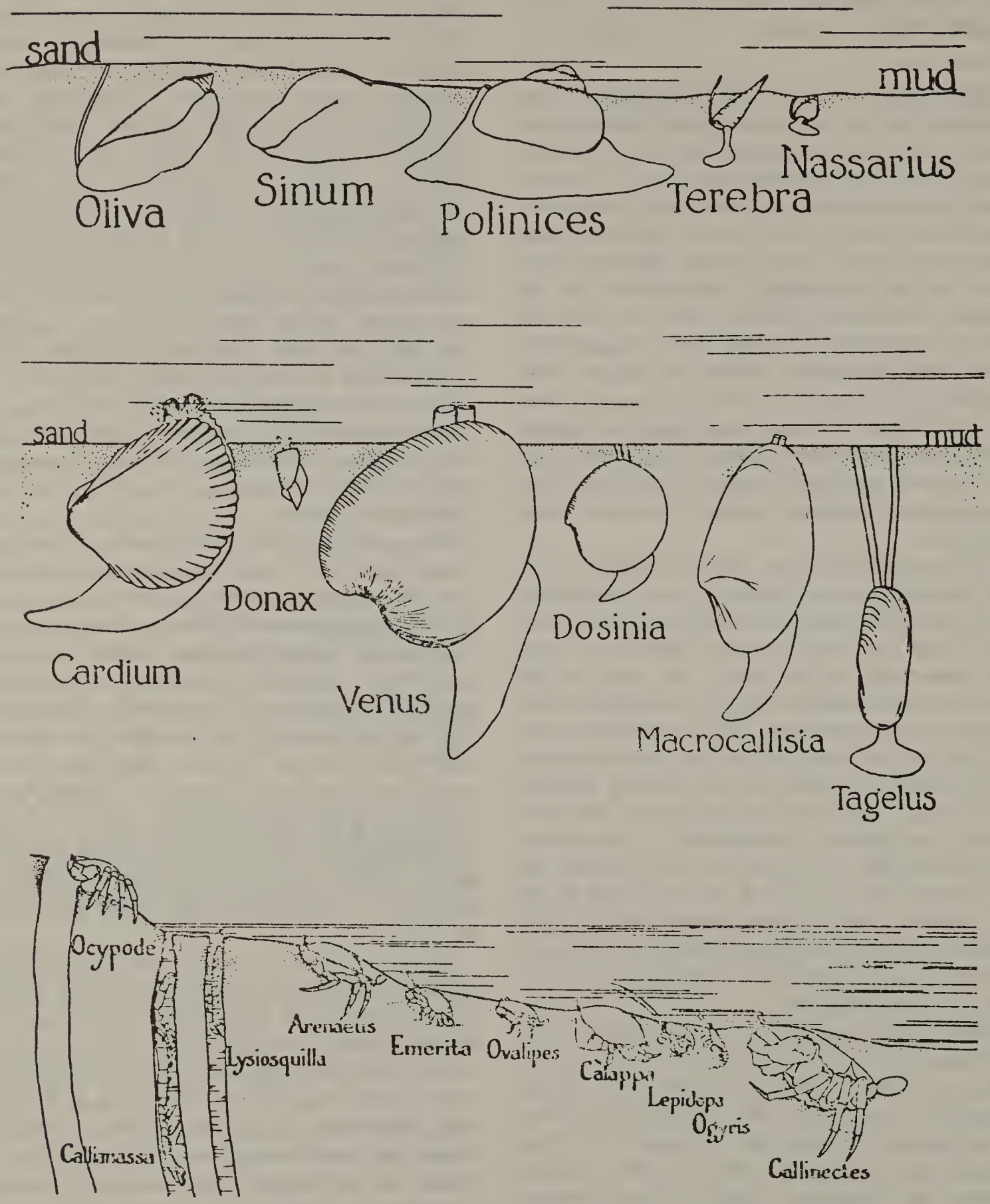
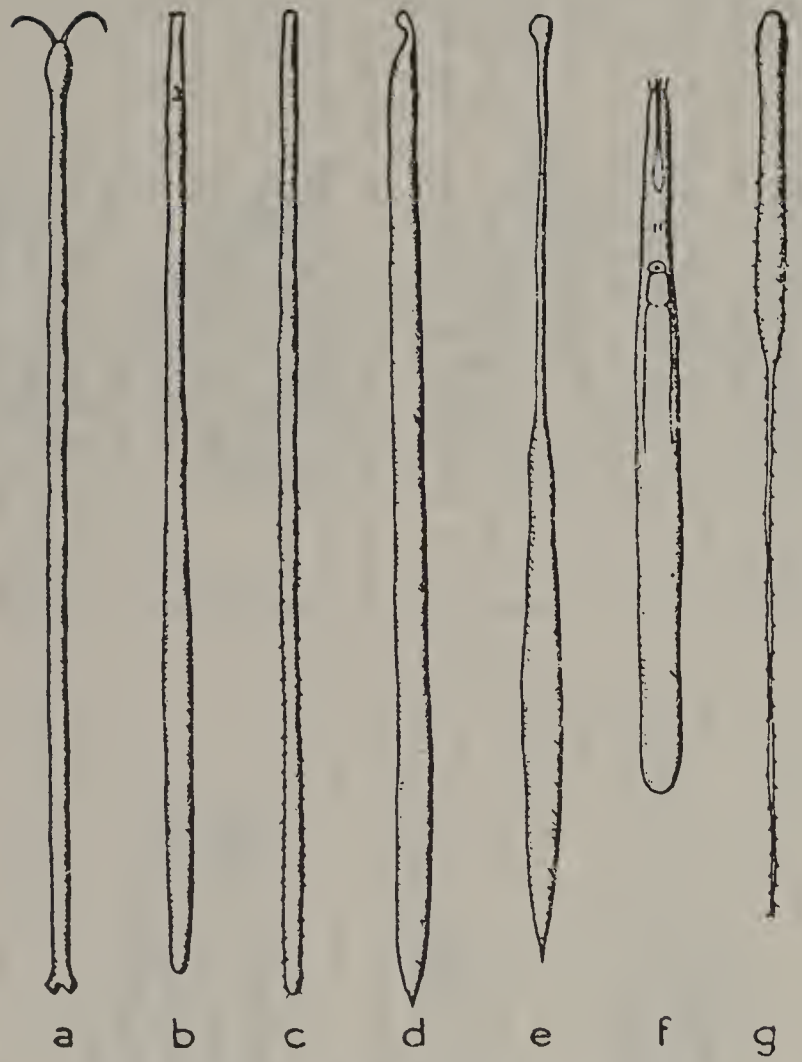
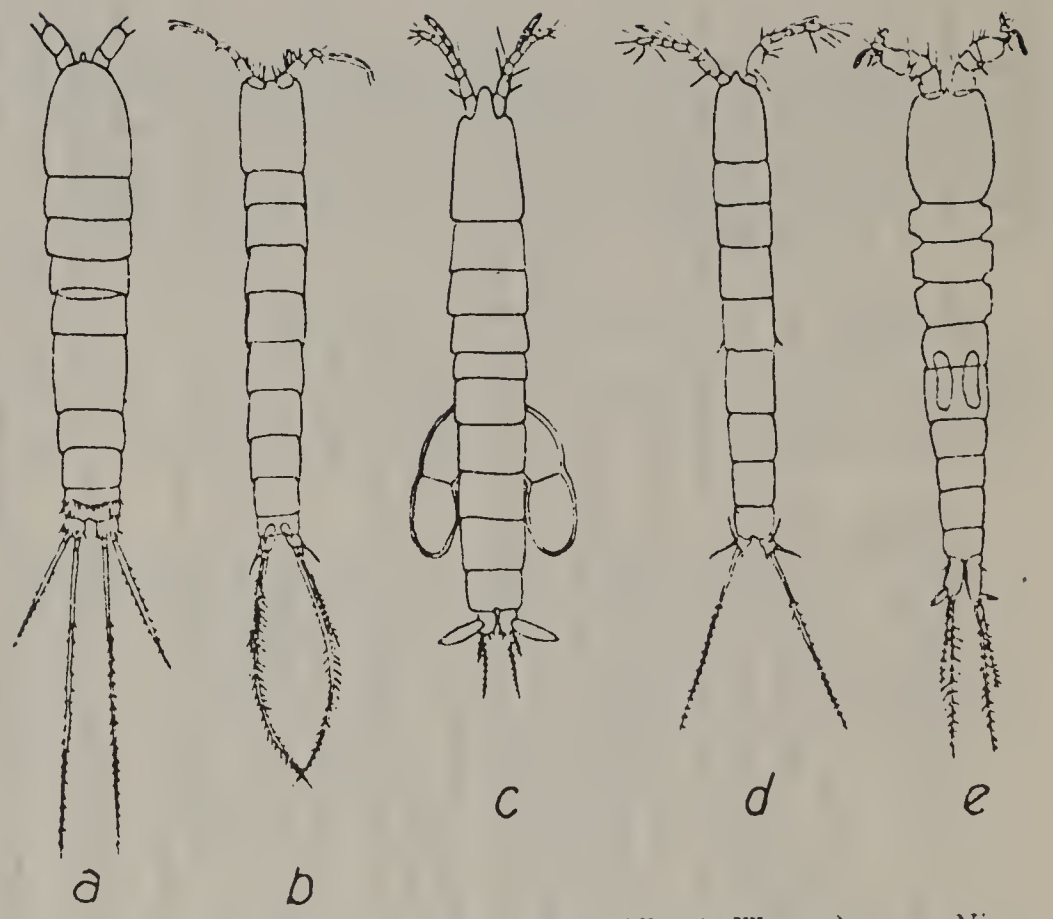


FIGURE F-1 Macrofauna (endopsammon) of sand beaches at Beaufort, N.C. Burrowing snails, bivalves and crustacea. (From Pearse, Humm and Wharton, 1942)

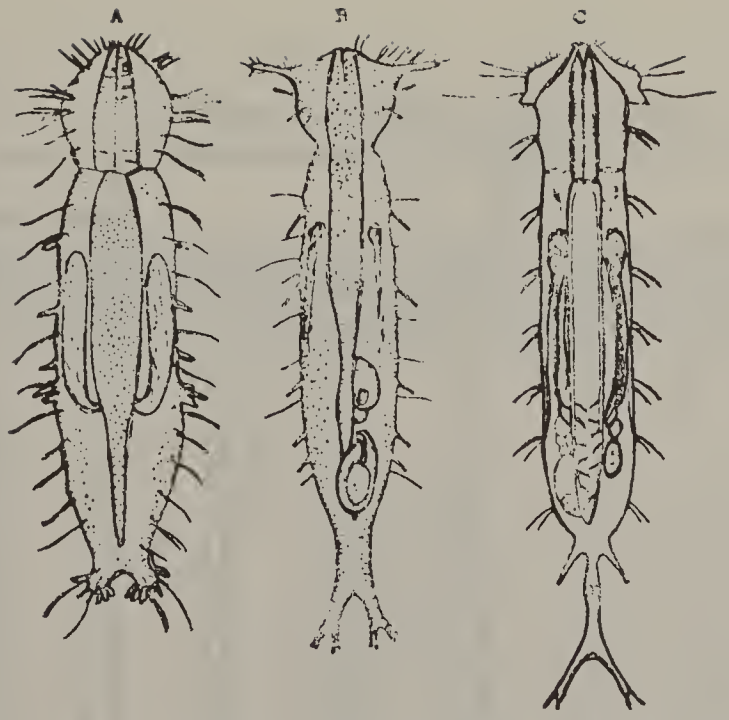


– Convergence chez divers groupes interstitiels. — *a*, *Protodrilus chaetifer* (Archiannélide). — *b*, *Coelogynopora* sp. (Turbellarié). — *c*, *Michaelsena* (Oligochète). — *d*, Cilié. — *e*, *Trachelocerca* (Cilié). — *f*, *Proschizorhynchus oculatus* (Turbellarié Rhabdocoele). — *g*, *Urodasys mirabilis* (Gastrotriche) (d'après REMANE, 1953).

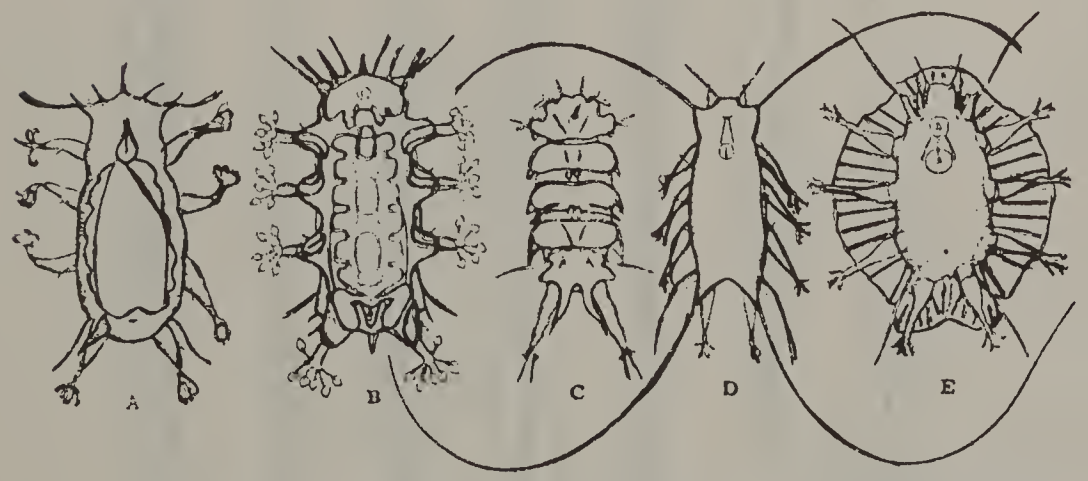


– *Copépodes psammiques marins* (d'après WILSON). — *a*, *Nitocra chelifer*, femelle, vue dorsale. — b, *Arenosetella spinicauda*, mâle. — c, *Goffinella stylifer*, montrant les ovicacs appliqués et les œufs de grande taille. — d, *Paraleptastacus brevicaudatus*, femelle. — e, *Emertonia gracilis*, mâle.

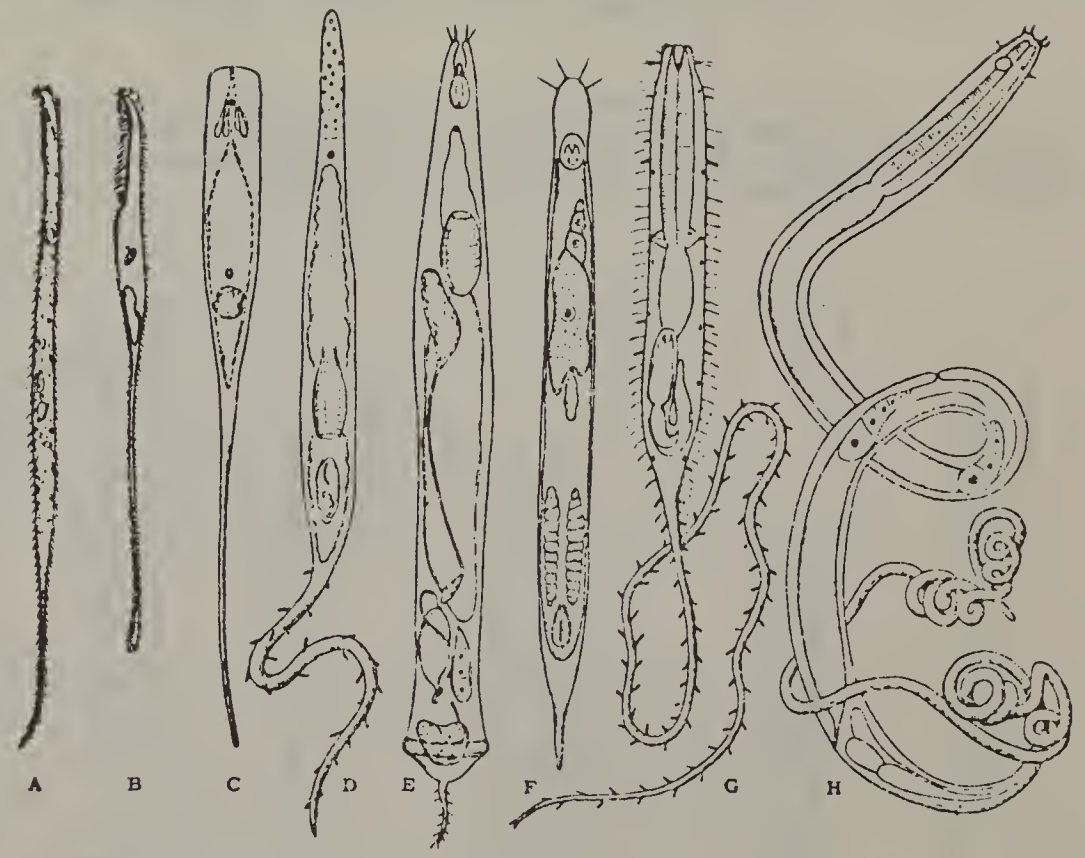
FIGURE F-2 Mesopsammon (archiannelids, turbellarians, oligochaetes, gastrotrichs, and copepods), minute organisms which live between the sand grains on beaches (From Delamare 1960)



Gastrotrichen der Ordnung Macrodasyoidea. Differenzierung eines Gabelschwanzes in der Familie Dactylopodalidae. A) *Dactylopodalia baltica* REMANE, B) *Dactylopodalia cornuta* SWEDMARK, C) *Dendrodasys gracilis* WILKE (aus Ax 1963).



Mesopsammale Tardigraden der Ordnung Arthrotardigrada. A) *Halechiniscus subterraneus* RENAUD-DEBYSER, B) *Batillipes mirus* RICHTERS, C) *Stygarctus bradypus* SCHULZ, D) *Tanarctus tauricus* RENAUD-DEBYSER, E) *Actinarctus doryphorus* SCHULZ (nach RENAUD-DEBYSER, 1949b, MARCUS 1936, SCHULZ 1951, GRELL 1937).



Differenzierung eines Schwanzfadens in der interstitiellen Sandfauna. A) *Remanella caudata* DRAGESCO (Ciliata), B) *Spirostomum filum* (EHRBG.) PÉNARD (Ciliata), C) *Mecynostomum filiferum* Ax (Turbellaria Acoela), D) *Boreocelis urodasyoides* Ax (Turbellaria Proseriata), E) *Cheliplanilla caudata* MEIXNER (Turbellaria Kalyptorhynchia), F) *Gnathostomula paradoxa* Ax (Gnathostomulida), G) *Urodasys viviparus* WILKE (Gastrotricha Macrodasyoidea), H) *Trefusia longicauda* (DE MAN) (Nematodes). — (nach verschiedenen Autoren aus Ax 1963).

FIGURE F-3 Mesopsammon or interstitial sand fauna (Gastrotrichs, tardigrades, ciliates, turbellarians, gnathostomulids, nematodes) (From Ax 1966)

with terrestrial affinities, but some marine types inhabit or use the area.

Most conspicuous among the invertebrates of this zone is the ghost crab or sand crab (*Ocypode quadrata*). Although of marine origin, the adult ghost crab lives in burrows along the upper beach and well back into the dunes. Primarily nocturnal, the ghost crab forages as a scavenger and predator (Johnson, et al., 1974).

The upper beach also serves as a nesting area for certain species. Loggerhead turtles, with ancient evolutionary ties to the terrestrial environment, instinctively return to the beach to lay eggs (Visual No. 5).

Several species of birds nest on the upper beaches. These include the royal tern, least tern, American oyster-catcher, Wilson's plover, and willet (Johnson et al., 1974). The nesting rookeries of these and other species are depicted on Visual No. 5.

Except for the loggerhead turtle and the ghost crab, animals using the dunes are terrestrial. Data on food habits of animals from dune areas are lacking, but it is evident that many species forage in the dunes.

Sea oats, in addition to their important role in dune formation and stabilization, also form an integral part of the food web involving important animals characteristic of the habitat. Tippins and Beshear (1968) reported scale insects (*Duplasionaspis*) infesting sea oats, and Circulapis and Odonapis seriously affecting other dune grasses (*Spartina* and *Panicum*). Wagner (1964) reported 15 species of beetles and three species of sucking bugs associated with sea oats panicles during flowering. *Collops nigriceps* and *Isomira* sp. were especially common. He examined the stomach contents of seven individuals of each of these species and found that all contained pollen grains of sea oats.

Both the old field mouse and the cotton mouse occur on some, but not all of the Georgia islands. On Cumberland Island, cotton mice commonly forage in the dunes. On the mainland, the cotton mouse is usually found in relatively moist habitats, and the old field mouse is more common in drier habitats (Golley, 1962). Few data exist on the food habits of either species on the islands.

The marsh rabbit is a common animal frequenting the dune area. Droppings are frequently observed in the sheltered area behind the dunes. Exact food habits of marsh rabbits are not known, but cut stems on Sapelo and Blackbeard islands indicated that they were feeding on sea oats.

Songbirds, especially song sparrows and other fringillids, and red-winged blackbirds are the major consumers of the sea oats seeds. Sea beach panic grass, which produces a panicle of large seed, is no doubt a very important source of food for seed-eating birds and mammals. Beach hogwort and beach primrose probably also contribute to the diet of these birds (Johnson, et al., 1974).

Trees and shrubs that grow in the lee of the rear dunes produce large quantities of fruit and seed that are heavily utilized by a variety of animals including such larger, important species as wild turkeys, raccoons, deer, and hogs. Notable among these plants are live oak, wax myrtle, saw palmetto, yaupon, and dahoon (*Ilex cassine*) (Johnson, et al., 1974).

Feral hogs visit the dunes to forage on beach pennywort. Cattle graze on sea oats and other grasses and forbs on the dunes. (Johnson et al., 1974).

2. Sea Grasses

Considerable data have been written concerning sea grass ecosystems. Phillips (1974) provides a good summary on the distribution and ecology of eelgrass (*Zostera* spp.) in the temperate regions and Roberts (1974) described the sea grasses of the South Atlantic region.

The dominant submerged grass in high salinity areas in the South Atlantic coastal region is eelgrass (*Zostera marina*) a northern species. It forms extensive beds in Pamlico, Core and Bogue sounds of North Carolina during the spring and summer months (Dillon, 1966, 1971). The southern limit of *Zostera* is given as Beaufort, N.C. by den Hartog (1970) but probably extends south of Bogue Sound where it was reported by Dillon (1966, 1971). It is reputedly absent from South Carolina and Georgia. Distribution maps are not reproduced here because the limits of these beds are not clearly defined and vary through time.

During the winter months, *Zostera* is replaced by *Halodule beaudettei* (Dillon, 1966, 1971). *Halodule* is a southern species which occurs discontinuously from North Carolina to the Caribbean and Gulf of Mexico. Roberts (1974) reports that it does not occur in South Carolina and Georgia probably because of the water turbidity and tidal amplitude of the area.

In North Carolina, *Halodule* becomes dominant after the decline of *Zostera* in September. Active growth begins in May, before *Zostera* reaches its peak. *Halodule* reaches maximum biomass (105-200 g/m^2) in October to December, although it is present throughout the year. A significant portion of this biomass peak is due to the epiphyte, *Ectocarpus* sp., rather than *Halodule* itself (Dillon, 1971).

Turtle grass (*Thalassia testudinum*) and manatee grass (*Syringodium filiforme*) are common sea grasses on the south Florida coast, but are not reported from the northeastern Florida coast. *Thalassia* is reported to reach its northern limit at Cape Canaveral; Syringodium apparently does not reach Cape Canaveral (Moore, 1963).

Throughout the region, widgeon grass (*Ruppia marina*) is found in low salinity waters. Several freshwater species tolerant of brackish water, such as *Potamogeton* spp., are often associated with it.

In the southern portion of its range, Halodule is subordinate to *Thalassia*, *Syringodium* and other sea grasses, achieving dominance only when these genera are absent or in a period of decline.

Sea grasses form an important habitat for many faunal and floral species. Allee (1923a, 1923b) reported 138 faunal species associated with eelgrass beds in Woods Hole, Mass. Stauffer (1937) organized the microhabitats of these animals into four categories: those growing on the plants; those swimming among the plants; those living on the mud surface; and burrowing forms.

In category one, most animals existed as epiphytes or clung to the leaves. These included anemones, encrusting bryozoa, hydroids, isopods, protozoa (ciliates and flagellates) and small crabs.

In category two, numerous species of fish and crustaceans such as the amphipods, copepods and cladocerans occur.

A great number of organisms lived on the mud surface in and near the eelgrass system. These included the entire list of detritus feeders, i.e., crabs, many different molluscs, worms, some fish, small and larger commercial shrimps, amphipods, rotifers, myriads of nematodes, sea cucumbers, brittle-stars, starfish, sea urchins, and occasionally sea-pends. Many flatfish live on the substrate surface in eelgrass. The bay scallop (*Argopecten irradians*) and the soft clam (*Mya arenaria*) are two commercially important species that utilize the grass beds for setting of the larvae.

Among the burrowing forms in category four, representative species include worms, some molluscs, brittle stars and some crustaceans such as the blue mud shrimp or mud pawn (*Upogebia*).

Sizable literature exists pertaining to the use of eelgrass by waterfowl in North America and Europe. Cottam (1934) established that eelgrass constituted 80% of the winter food of the sea brant goose and was an important food to several other species. McRoy (1966) estimated that Black brant and Canada geese consumed about 17% of the standing stock of eelgrass in Izembek Bay, Ak., during the summer and autumn feeding period. Winter waterfowl surveys by the U.S. Department of the Interior (1973 and 1974) indicate significant concentrations of waterfowl utilizing the sounds of North Carolina and thus probably depend on the seagrasses to some extent.

Phillips (1974) believes that the eelgrass system is one of the richest in terms of variety and abundance of life in the sea. Eelgrass plays several roles: as a substrate for organisms which could not otherwise live on a soft substrate; it is used as food for a small number of animals; products resulting from eelgrass breakdown support a large diversified community of animals; and the physical presence of the plant on an unconsolidated muddy bottom provides protection and cover for organisms requiring quiet or silt-free water. Thus, the association with eelgrass is direct and indirect. It appears that a very large number of animal forms have adapted in interrelated ways to the various types of microhabits that an eelgrass system presents.

3. Mesohaline Systems

Odum et al. (1974) have described the mesohaline system and the following is taken from their publication.

The image most people see when one says "estuary" is the medium salinity, moderate depth bay which has much fishing but not much visible evidence of anything else. The bay draws support from food webs of invisible microscopic plankton supporting the characteristic populations of crabs, fish and commercial shrimp. Many of our largest estuaries are predominantly of this type although they are often fringed and bordered by smaller subsystems of other types. High nutrient levels and good stirring mechanisms generally produce high photosynthetic rates wherever clarity of water is maintained although the rates are less

than those found in systems like the marshes which have less water to absorb light.

In winter, with low light and well stirred waters due to tidal shifting and some turbidity from rivers, the plant cells spend too much time in the shade and stop making much food. In the spring as light conditions increase, the critical condition at which the plant cells can make a net gain is reached and there is a sudden bloom of some of the diatoms that sets off the seasonal production sequence. During the winter there is organic particulate food remaining from the previous season, from marshes, from rivers, and other storages that allows some of the animal life to persist. With the rising burst of plankton growth there are some releases of larvae from clams, oysters and barnacles, and little water-flea-sized copepods develop. *Acartia* predominates this system throughout the east coast. Reproductions and migrations of shrimp and fishes that eat the zooplankton are timed to coincide with the increased yields of these small components so that the rise in stocks and consumption takes the rising production, most of which is entirely invisible to the man in the boat above unless he measures the phytoplankton, some index of its activity such as oxygen production, pulls a zooplankton net, or has some way to estimate the rising stocks of fishes and shrimp. The middle salinity estuary has species with some ability in their kidney systems to deal with salinity fluctuation, some ability to switch food intake from organic matter to phytoplankton base, and an effective temporal program for migration and reproduction so as to hook the need for more food to the timing of appearance of more food.

Whereas the bottom clams and the special subsystems of the bay margins are contributors, the main system is one of plankton and plankton eaters. As the sunlight begins to decline after July, the population growth and reproduction declines and soon many populations migrate out again decreasing their load on the system.

Because the source of energy of this system is from microscopic phytoplankton, from invisible organic contributions from the rivers that support bacteria as intermediates, and from energetic services of tidal currents, rarely do persons not trained in marine science understand the basis for this system and its management. The food web is out of sight and thus out of mind.

The medium salinity estuaries often have partial stratification with wedges of dense salt water underneath. In systems allocated to this type, mixing is adequate to prevent anaerobic conditions from developing at the bottom even though oxygen is less there since respiration is higher at the bottom of the estuary than at the surface. Estuaries tend to be deeper as one goes north, but also the amount of tidal energy available for currents and mixing and eddy diffusion coefficients increase.

Mesohaline systems which occur within the area under consideration include the Cumberland River, St. Catherines Sound and Ossabaw Sound in Georgia; Port Royal Sound, St. Helena Sound and Winyah Bay in South Carolina; Cape Fear River, New River and the Pamlico Sound complex in North Carolina.

Bellis (1974) has summarized the geographical variation in southeastern U.S. estuaries as follows:

The markedly different oceanic biotas north and south of Cape Hatteras are not reflected in coastal systems behind the barrier islands. Shape and depth constitute the primary difference between Chesapeake Bay and the North Carolina Sounds. Shallow depth and dampened tidal effects promote good mixing. Water masses tend to be relatively turbid and move about in broad gentle swirls rather than as part of a current. Patterns of water movement depend in large measure on wind direction and velocity. In reality, the sounds are shallow basins into which the estuaries empty. Lower levels of the food web in these sounds have been incompletely studied. In general, production is accomplished by diatoms and dinoflagellates. This energy moves up to the nekton level via copepods. Dominant nekton are of the characteristic "southern" types (e.g. bluefish, striped bass, flounder, mullet, and shad). Bluecrab (*Callinectes*) and menhaden (*Brevoortia*) are abundant and of considerable economic importance.

North Carolina's sounds constitute the largest estuarine system along the Atlantic coast. Most of this vast system is of the medium salinity, (5-18 ppt), plankton-based type and as such functions as a nursery or a temporary home for migrating nekton of commercial importance. Shrimp, striped bass, and menhaden do most of their "growing" during periods spent in the sounds or near shore coastal waters where they become the beneficiaries of a high level of phytoplankton production.

In estuarine systems such as this, efficiency of energy transfer between plant and animal is greater than in most land environments. This is so because the producer components of the food web are primarily diatoms. Diatoms convert some of their carbon intake to energy-rich (high calorie) fats and oils while most green plants store carbon as less rich carbohydrates.

South of Cape Fear, rivers such as the Pee Dee in South Carolina and the Savannah in Georgia empty into the sea via low marshland. Extension barrier islands, of the type responsible for formation of the North Carolina sounds, are absent or much reduced in importance. Consequently, estuaries along this portion of the Atlantic Coast have been described as a "muddy river mouth" type. Here the "middle-salinity-plankton-based" system consists of tidal channels through the salt marsh, major portions of the Charleston and Georgetown harbors, and a 16 to 19 km wide strip of "estuarine" water which remains trapped between higher salinity ocean water and the beach. Sport fisheries, dependent at least in part on the middle estuary plankton, are similar to those of the North Carolina sounds. Commercial fisheries involve primarily oysters and blue crabs, both of which are directly dependent upon the plankton during one or more stages of their life cycle. Shrimp become of increasing commercial importance southward along the Georgia coast.

One general characteristic of plankton organisms of the middle estuary is that, while they may be volumetrically abundant, they tend to be limited with respect to species variety (Riley 1967).

In terms of actual numbers, as well as number of species, the great majority of estuarine plankton organisms belong to just four major groups. Calanoid copepods are the largest in size and adults may be just visible without magnification. Photosynthetic dinoflagellates and elongate diatoms are next in order of size and usually require magnification to be seen. Various algae, frequently flagellates, comprise the smallest members of the plankton (nanoplankton) which in many situations form a very significant fraction of the photosynthetic biomass.

Diatoms and dinoflagellates are of comparable size and are usually collected and studied together. Essentially, these organisms constitute the "net phytoplankton". Riley (1967) reported a total phytoplankton flora of 150 species for Long Island Sound. Weighting for consistency and relative dominance, he suggested that perhaps 13 species could be considered "native'. to the estuary. Of these 13 species, nine were diatoms and four were dinoflagellates. Phytoplankton community structure is similar to that of the zooplankton in that a single species, the diatom *Skeletonema costatum*, is characteristically dominant. Concentrations of this diatom reaching 35 x 10^6 cells per liter were observed by Riley and Conover (1967) in Long Island Sound. The fact that the percentage composition of *S. costatum* is similar in several estuaries (Narragansett Bay, 81.2%, Smayda (1957); Block Island Sound, 83.5%, Riley (1952); and James River, 83% Marshall (1967)) suggests that a "characteristic" estuarine phytoplankton structure is a real entity.

The diatom flora of the middle estuary is diverse and varies seasonally as well as geographically. Even so, *Skeletonema costatum* is frequently overwhelmingly dominant and important associate species, while variable, represent relatively few genera. Many estuarine diatoms may be strays which achieve success only on rare occasions. By considering only species that were well enough suited to the environment to be significant in normal patterns of seasonal periodicity, Riley (1967) reduced the important diatoms of Long Island Sound to six genera including nine species: *Skeletonema costatum*, *Thalassionema nitzschioides*, *Paralia* (*Melosira*) *sulcata*, *Schroderella delicatula*, *Thalassiosira decipiens T. gravida*, *T. nordenskioldii*, *Rhizosolena sertigera*, and *R. delicatula.*

Various dinoflagellates, though seldom as numerically important as the diatoms, are characteristic components of the net plankton. In St. Andrew Bay, Fla., diatoms clearly dominated the phytoplankton (Hopkins, 1966). Although little quantitative data were given concerning non-diatom groups, armored dinoflagellates were sparse. Ceratium spp. occurred rarely and silicoflagellates, mainly *Dichtoyoca*, were sparse.

Perhaps typical of the taxonomic analysis of estuarine phytoplankton is the distribution given by Marshall (1967) of 74 phytoplankters identified from Willoughby Bay and Hampton Roads, Va., 52 were diatoms, 19 were pyrrophytes (dinoflagellates), one chlorophyte, one euglenophyte, one cyanophyte, and two crytophytes. *Skeletonema costatum*, *Asterionella japonica* and *Nitzschia pungens* var. *atlantica*, were

abundant in colder weather while phytoflagellates were present throughout the year but reached peak abundance during the warmer months. A generally similar taxonomic distribution was reported by Kawamura (1966). Of 104 phytoplankton species in Sandy Hook Bay, New Jersey, 60% were diatoms, 22% were dinoflagellates, and 2% cyanophytes.

Yentsch and Ryther (1959) suggested that the micro-flagellate population might comprise a significant proportion of the bulk of organic production in marine plankton systems. The basis for this suggestion came from their comparative studies of whole water samples and net samples in which it was shown that many small diatoms (*Nitzschia*, *Thalassiosira*, the "summer" form of *Skeletonema costatum*) and several other species exhibited only about 10% retention in a standard No. 25 mesh phytoplankton net. Many nanoflagellates (*Carteria*, *Dunaliella* and *Gymnodinium*) exhibited only 2% retention. Patten et al. (1963) got two very different pictures of the annual phytoplankton cycle in the lower Chesapeake Bay depending upon whether net concentrated water samples or whole water samples were used in the taxonomic analyses. In terms of dominance and fidelity, it may well be that certain nanoplankton such as *Chilomonas* spp. (Patten et al. 1963; Marshall 1967; Fournier, 1966) or *Nannochloris* and *Stichococcus* (Patten 1962, Ryther 1954) are at least as indicative of a distinctive estuarine plankton community structure as are *Acartia* and *Skeletonema*.

If there is a system-wide pattern of estuarine phytoplankton periodicity, it would seem to consist of repeating seasonal variations in the relative abundance of its three principal components: diatoms, dinoflagellates and nanoplankton (often nanoflagellates). In general, diatoms dominate the winter flora, but share or yield dominance to dinoflagellates during the summer. Nanoflagellates are usually present throughout the year, but may exhibit spring or fall blooms (Marshal, 1967).

Patten (1963) has pointed out that seasonal alterations in the structure of a phytoplankton community may occur as a result of: (1) differential reproduction and selective elimination of component species, and (2) water mass transfer and consequent dispersal or concentration. The resultant diversity changes, usually cyclic over many years, give in a single year, the appearance of ecological succession. The significance of diversity can be illustrated by conclusions drawn by Patten (1962) with respect to his study of species diversity in Raritan Bay. Higher diversity levels prevailed in the lower estuary, signifying higher biotope quality (greater variety in ecological niches) toward lower bay.

The calanoid copepod *Acartia tonsa* appears to be the most persistent and abundant zooplankter in the middle estuary. *Acartia tonsa* occurs from the Gulf of St. Lawrence to the Gulf of Mexico (Riley, 1967) and is perhaps the most characteristic biotic component of the middle estuary plankton.

Other important zooplankters associated with Acartia dominance are variable. Cronin et al. (1962) reported that in Delaware Bay *Eurytemora hirundoides*, *E. affinis*, *Pseudodiaptomus coronatus*, and *Neomysis americana*, together with *Acartia tonsa* were resident species which made the estuarine zooplankton in the mesohaline region distinctly different from the ocean or the river. *Oithona* spp. were among the more important zooplankton in St. Andrew Bay (Hopkins, 1966) or were among the principal grazers in Narragansett Bay (Martin, 1965) in portions of these estuaries dominated by *Acartia*.

Relatively few fish lead an entirely estuarine existence. Killifish (*Fundulus majalis*) appears to be the most abundant truly estuarine species in the Chesapeake region (McHugh, 1967). Other plankton-feeding herring-like fish move into the middle estuary only during a part of the year. The striped anchovy (*Anchoa hepsetus*) is abundant in Chesapeake Bay in the summer during which time its eggs are a common constituent of the plankton. Anchovies leave the bay during winter, and their position in the food web is occupied by the spotted hake (*Urophycis regius*). A similar seasonal pattern in hake (*Urophycis floridanus*) abundance has been reported from the Gulf Coast by Gunter (1945).

A variety of fish, several of considerable commercial value, use the middle estuary as a spawning ground or nursery. The hogchoker (*Trinectes maculatus*), bay anchovy (*Anchoa mitchilli*) and silver perch (*Bairdiella chrysura*) are important inshore fish which spawn in Chesapeake Bay (McHugh, 1967). Other fish, spot (*Leiostomus xanthurus*), Atlantic croaker (*Micropogon undulatus*), and Atlantic menhaden (*Brevoortia tyrannus*) spawn offshore during colder months. Upon hatching, the young move

rapidly into the estuary where they exhibit little growth until the return of warmer weather. Rapid growth occurs in summer as the young fish gradually move down the estuary and into more saline water.

The great majority of numerically or commercially important estuarine fish thus appear to be only summer residents of the middle estuary. Most explanations of fish migration involve correlations with seasonal "climate" patterns such as temperature, day length, breeding behavior, etc. However, the relationship of migration patterns to quantity and quality of food sources may be an equally important aspect of estuarine dynamics.

Plankton organisms form the dominant biomass of the middle estuary and thus constitute the base of its food web. Photosynthetic production by the phytoplankton serves as a direct source of biotrophic energy inflow. Invisible diatoms and phytoflagellates are the primary food of just visible copepods which in turn are eaten by relatively small herring-like fish. Figure F-4 represents the sort of complex web that can develop when food chains are integrated at the genus level.

A less obvious, but under some conditions equally significant, energy input is derived from import into the system of dissolved and particulate organic matter. At least in some estuaries, estimates of production capacity based on phytoplankton studies may be conservative because of failure to consider the availability of organic energy sources.

Moving water constitutes a force capable of doing work. Currents and the water masses which comprise them carry suspended organic and inorganic substances. Dissolved substances may become colloidal particles as they progress along a density-alkalinity gradient. This suspended load is important as a potential source of nutrients, in providing both a substrate and surface area for bacterial and fungal growth, as a direct source of food for filter feeders, and because its density affects water turbidity and thus the capacity for photosynthetic conversion of light energy.

Suspended organic matter may arise from: (1) detritus derived from normal biotic components of the water column, (2) import from upstream or the edge, (3) resuspension from the bottom resulting from upwellings and eddys or, (4) formation and aggregation of colloidal particles. Quantitative information concerning the relative importance of the various sources is lacking although the magnitude of non-living particulate material, relative to the phytoplankton concentration, is such that it constitutes a resource of potentially major significance in the trophic economy of inshore waters (Patten et al., 1966).

Moving water masses interact with the bottom in such a way that sediments are frequently picked up and redeposited elsewhere. Interaction between these sediments and their medium during transport results in mineral and nutrient exchanges. Large pieces of organic matter settle to the bottom and there become reduced to a smaller, more soluble, or colloidal state. Resuspension of this material would result in dispersal and increased surface contact with water. Since the organic components settle more slowly than the inorganics, water movement has performed work in bringing about a sorting process and the water phase becomes richer in dissolved and particulate organics. This change in chemical status may be further complicated in some environment or at certain seasons by the transfer of materials from a reducing environment on the bottom to an oxidizing one above.

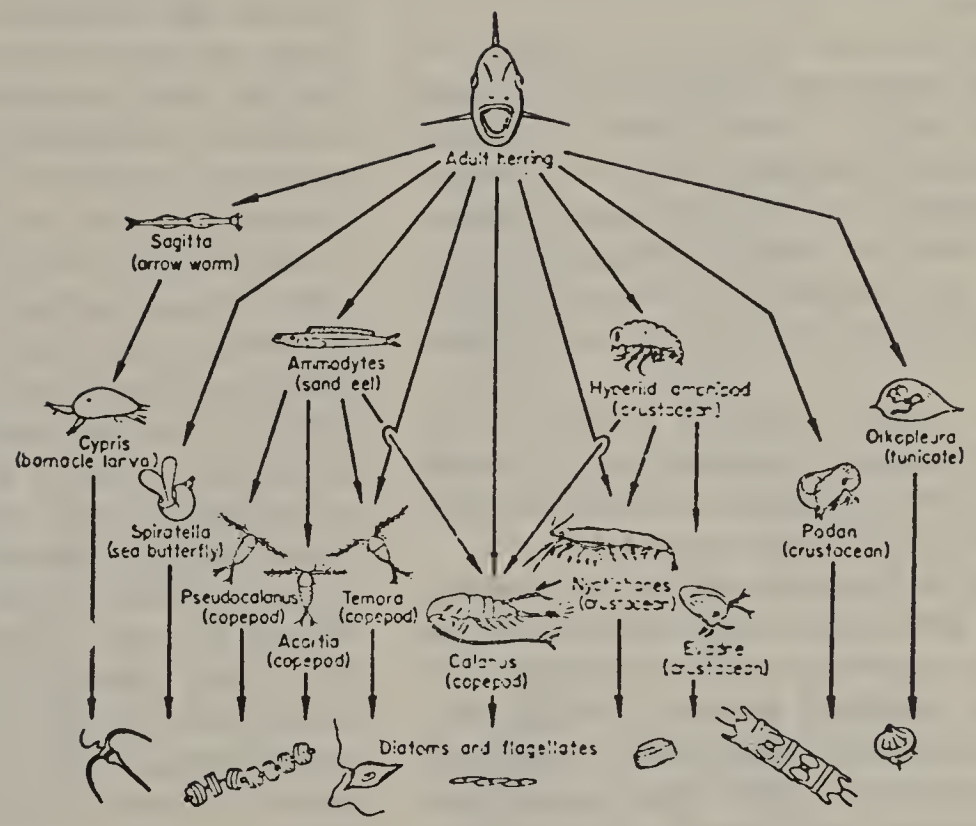
4. Oligohaline Systems

Copeland et al. (1974) have described the oligohaline system and much of the following is taken directly from their publication.

The distinctive system existing at the river mouth-estuarine area of most temperate estuaries is unique in many ways. The unidirectional flow of the river changes to the slowly mixing circulation of a wide shallow body of water, representing a change in energy from flow to circulation. The water is characteristically turbid and contains large amounts of silt materials coming in from the river. The bottoms are dominated by grass and filtering clams (*Rangia cuneata* in the southern temperate zone and *Mya arenaria* in the northern temperate zone, with some overlap in the intermediate zones).

The species diversity of the flooding system is relatively low. Because these rivers flow strongly at times, there are sudden fluctuations in salinity. It is this sudden change in salinity which eliminates many species. Those species that survive apparently possess adaptive abilities to divert part of their energies to salinity and turbidity adaptations.

Nutrients and organic detritus transported into the system are dependent on the source and



The feeding relationships of adult herring. (Based on HARDY, 1924 and 1959; courtesy of Collins.)

Fig. F-4 Food chains of herring-like fishes. This example is from Europe and involves some feeding outside of the middle salinity zones (ODUM AND COPELAND, 1974).

volume of flood waters via the contributing streams. After extensive flooding, for example, the river water is relatively poor in nutrients and organic matter.

These systems manage to consume and produce at high levels in spite of the heavy import-export flux, light-absorbing turbidity and salinity shocks. According to Odum (1967) populations of *Rangia* may exceed 12/ft² in some areas. With a large filtering rate, imported organics are captured, minerals are released from the imports and waters are cleared by aiding flocculation, all of which provide a regenerative feedback of minerals to the phytoplankton.

Systems of this type which occur within the planning area include the mouths of: St. Lucie Canal, Indian and St. John's rivers in Florida; Satilla, Altamaha, Canoochia and the Savannah rivers in Georgia; Broad, Combahee, Edisto, Cooper and Pee Dee rivers in South Carolina; Cape Fear, New, White Oak, Neuse, Pamlico, Champan and North Landing rivers in North Carolina.

Probably the best understood of these is the Pamlico River estuary, the major part of which constitutes a typical oligohaline system in which salinity is normally less than 10 ppt.

The estuary is characterized by low salinity, high turbidity and shallow water. Some of the important energy transfers have been deduced and are shown in simplified diagram in Figure F-5. The more abundant and characteristic organisms in the system are named rather than using a broad general classification. For example, dinoflagellates and *Acartia tonsa* dominate the phytoplankton and zooplankton, respectively.

Because the estuary is shallow and the deeper waters are frequently low in dissolved oxygen during the summer, most of the benthis invertebrate species occupy the sandy, nearshore sediments. These shallow waters of low salinity have dense stands of *Ruppia* with attached periphytic algae and associated animals, particularly rotifers, polychaetes, nematodes, gammarid amphipods and grass shrimp (*Paleomonetes* sp.). Of the two dominant species, *Macoma balthica* appears ubiquitous, whereas *Rangia cuneata* is restricted to the oligohaline portion of the estuary. In a recent study, Tenore et al. (1968) demonstrated that *Rangia* receive a major part of their nutrition from organic matter in the substrate, which may be a function of input from the river.

The estuary is protected by Pamlico Sound and the outer banks so that the diurnal tidal amplitude averages less than 20 cm. The flushing rate is correspondingly low and entrained particles tend to remain in the estuary for long periods of time. Salinity is low in the spring and increases to maximum values in the fall or winter. Changes in salinity seasonally seem to be associated with variation in fresh water runoff as suggested by Roelofs and Bumpus (1953). Williams and Deubler (1968) indicated that this general salinity cycle is characteristic of North Carolina estuaries. The plankton based system of Pamlico Sound replaces most of the oligohaline system of Pamlico River during the fall and winter months. However, during the more productive time of the year, the system is essentially oligohaline, particularly in the shallow water where most of the species exist. Typically, a zone of reduced dissolved oxygen develops in the bottom one meter of the water column during periods of the summer. This zone is brought about by a combination of thermohaline vertical stratification, a high surface turbidity and reduced wind stress. If these conditions persist for a period of time, dissolved oxygen concentration falls, often below 1 mg/l. This characteristic of Pamlico River may be responsible for the virtual absence of macro-benthic invertebrates from the deeper water sediments (Tenore et al. 1968). *Macoma balthica* does occur, but may suffer severe mortalities in years when dissolved oxygen concentrations drop to particularly low values or persist for relatively long periods of time.

The euphotic zone is generally restricted to the upper two meters of the water column. This feature, coupled with the shallow nature of the estuary, may be responsible for the relative scarcity of diatoms in the phytoplankton. The phytoplankton is dominated by motile dinoflagellates which would seem to have an advantage over the heavier diatoms in their ability to remain in the surface euphotic zone. *In situ* phytoplankton C^{14} assimilation experiments during 1967 yielded average values which compare favorable with data collected by Williams (1966) for a nearby, but more saline environment, in North Carolina. However, there was no apparent seasonal cycle, and average values fluctuated considerably from one sampling period to the next, although there was better agreement among stations at any one time. Peak assimilation values in

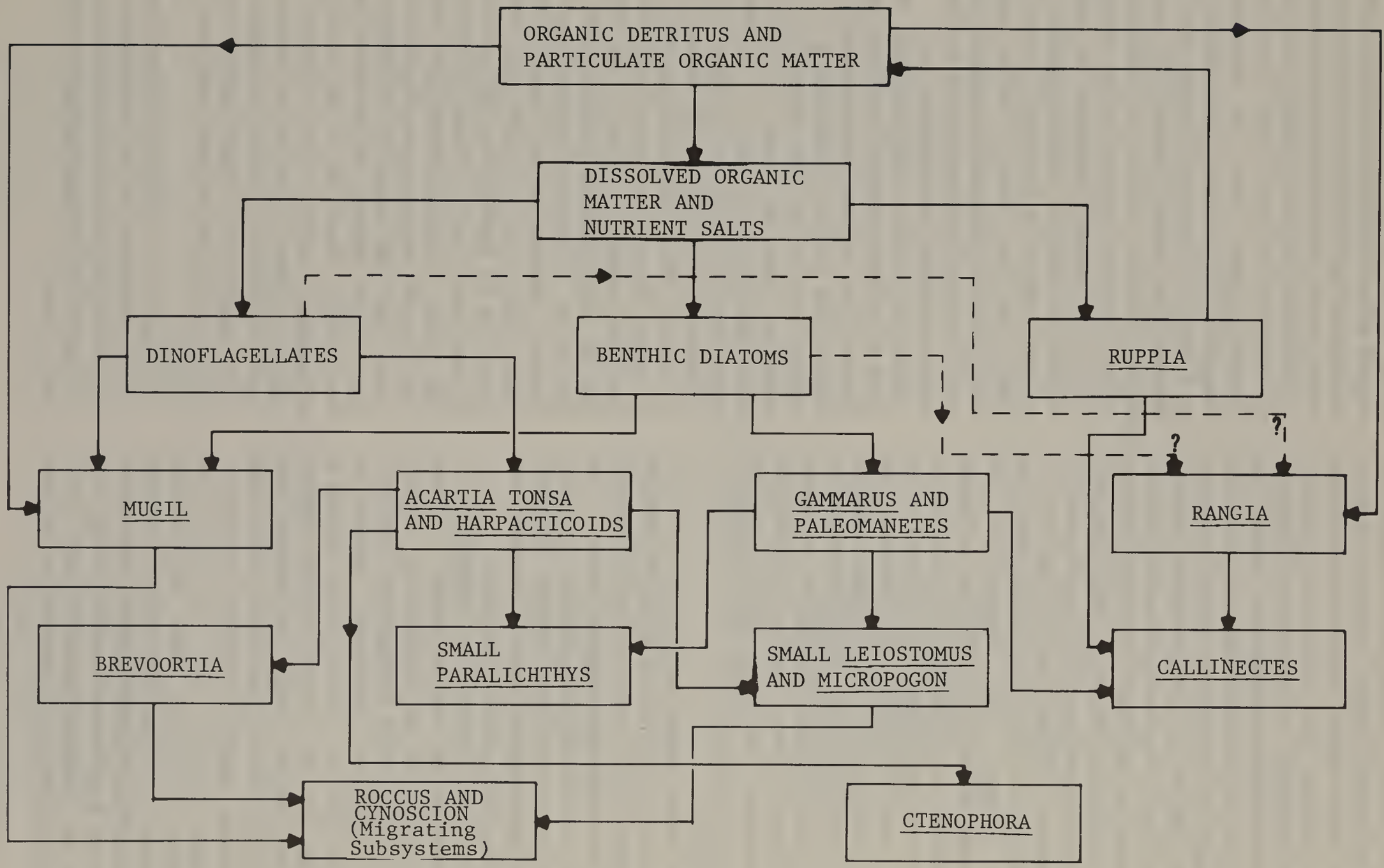


Figure F-5 Simplified diagrammatic representation of major food web components in the Oligohaline System, Pamlico River Estuary, N.C. (Odum and Copeland, 1974).

excess of 200 mg C/m²/day were estimated for dates in November, January, February and June. Perhaps stormy weather, including wind mixing and accompanied by nutrient-rich rainwater (Reimold and Daiber, 1967), creates conditions allowing brief bursts of phytoplankton activity. The standing crop of phytoplankton did not reflect the fluctuations in C^{14} assimilation. Biomass estimates by direct count and cell size calculations averaged less than 7 mg/l except during the period between mid-January and mid-March when peak concentrations averaged greater than 30 mg/l. This early spring bloom was attributed to a single species of dinoflagellate, *Peridinium triquetrum* and was studied intensively by Miller and Hobbie during the 1967-68 flowering. They suggest that the dinoflagellate bloom, which is atypical in Atlantic coast estuaries where diatoms are usually dominant during the spring flowering, is related to low salinity, high metabolite concentrations, low nutrients, shallow water or the shallow euphotic zone of the estuary. Peters (1968) showed that the seasonal cycle of particulate carbon in Pamlico River followed the same trend as did chlorophyll *a* concentrations. This may indicate a rapid turnover of both phytoplankton and oxidizable organic matter.

In the shallow inshore waters less than two meters in depth, dense stands of rooted macrophytes are present. *Ruppia maritima* dominates this community in the typically oligohaline portions of the estuary where salinity ranges between 3 to 10 ppt, but *Potamogeton* sp. is also common. The blades of both species accumulate a rich epiphytic and animal biota during the growing season.

Peters (1968) studied the distribution of zooplankton in the Pamlico estuary. He found *Acartia tonsa* to be the most abundant copepod species present as did Herman et al. (1968) in a similar oligohaline environment. Harpacticoid çopepods were very common in his samples at night, but were in extremely variable numbers; they were virtually absent from samples taken during daylight hours. In one instance the average concentration (samples were taken vertically at one meter intervals) was over 18,000 individuals/m³ or about twice the maximum holoplanktonic concentration observed. He found that some of the variability could be explained by wind speed. Harpacticoid abundance in the water column was positively associated with surface wind velocity. Peters suggests that the harpacticoid copepods are positively rheotactic and respond to the wind induced turbulence, although light appears to be the main factor for the entrance and exit from the plankton community.

Ctenophores are also abundant and dominate the plankton at times. There is an apparent seasonal bimodal cycle of abundance of ctenophores with peaks during the spring and fall. In a study of ctenophore feeding rates in the Patuxent River estuary, Bishop (1967) estimated that approximately 31% of the standing crop of *Acartia tonsa* was cropped by the ctenophores each day. Although ctenophores are apparently efficient and important carnivores, the fate of this consumed energy is unknown. Herman et al. (1968) cite two fishes, *Peprilus alepidotus* (harvestfish) and *Poronotus tricanthus* (butterfish) which feed on adult ctenophores, but neither species is abundant in Pamlico River.

Keup and Bayless (1964) described the fish fauna in a similar estuary (Neuse River) in North Carolina. They collected fish by rotenone from 18 stations with a salinity range from 0 to 12 ppt, although only six of their stations were more saline than 4 ppt. They found 42 primarily freshwater species and 20 salt-water or brackish-water forms. They did find a broad overlap of fresh and salt-water fish distributions with respect to salinity, however. This supports the view that there is no sharp demarcation between oligohaline and mesohaline estuarine systems and that freshwater fish can and frequently do enter water with a salinity of 10 ppt or greater (approaching isosmotic conditions) and salt-water fish are commonly found in very low salinity water during the summer. In the Pamlico River, fish were sampled by otter trawl at several stations at monthly intervals during the spring, summer and winter of 1965. Samples taken in water of salinity between 3 and 10 ppt were composed substantially of salt-water species although the method of sampling was probably responsible for the virtual absence of freshwater species in the collections. Twenty species in addition to the salt and brackish-water forms mentioned by Keup and Bayless (1964) were collected. Most of these were species which only stray into the estuaries during the summer months.

Copeland et al. (1974) reported that the dominant fish inhabiting the major oligohaline portion of Pamlico River are primarily salt-water species. The permanent and semi-permanent species are given in Table F-1.

Table F-1. Permanent and semi-permanent salt-water species inhabiting the oligohaline system (5-10 ppt) of Pamlico River, N. C.

Adapted from Copeland et al. 1974)

Permanent Residents	
Common Name	**Scientific Name**
Common mummichog	*Fundulus heteroclitus*
Rainwater killifish	*Lucania parva*
Naked goby	*Gobiosoma bosci*
White perch	*Morone americanus*
Striped anchovy	*Anchoa hepsetus*
American eel	*Anguilla rostrata*
Hogchoker	*Trinectes maculatus*
Bay anchovy	*Anchoa mitchilli*

Present Year-round Except During Winter	
Common Name	**Scientific Name**
Tidewater silverside	*Menidia beryllina*
Rough silverside	*Membras vagrans*
Common silverside	*Menidia menidia*
Spot	*Leiostomus xanthurus*
Atlantic croaker	*Micropogon undulatus*
Pinfish	*Lagodon rhomboides*
Atlantic menhaden	*Brevoortia tyrannus*
Summer flounder	*Paralichthys dentatus*
Northern pipefish	*Sygnathus fuscus*

Migrating through September	
Common Name	**Scientific Name**
Hickory shad	*Alosa mediocris*
Alewife	*Alosa pseudoharengus*
Glut herring	*Alosa aestivalis*
American shad	*Alosa sapidissima*
Gizzard shad	*Dorosoma cepedianum*
Striped bass	*Morone saxatilis*
Common sturgeon	*Acipenser oxyrhynchus*

The overwhelming characteristic of the oligohaline systems is the low salinity and great shocks of freshwater floods. Organisms capable of surviving the rigors of the system are few, but those that do, manage to flourish during certain seasons of the year. Important adaptations include attachment to avoid being swept away during high flow rates and the ability to withstand salinity variations.

Plants in the oligohaline regime include such freshwater forms as *Najas* and *Potamogeton* and the brackish water plant *Ruppia maritima*. Benthic diatoms are common on the oligohaline mud flats and dinoflagellates dominate the phytoplankton.

Fauna include certain molluscan species that have special filtering ability to utilize the tremendous organic content of the muddy river water. *Macoma balthica*, for example, seems to be a common inhabitant of southern oligohaline zones, but is normally replaced by other clams in more northern areas. *Nereis succinea*, a polychaeta, is common in the zoobenthos of all oligohaline systems within the study area.

Migrating subsystems are important constituents of the oligohaline system and channel much of the energy harvested by man. Common among these migrating forms are the herring-like plankton-feeding fishes represented by shad (*Alosa sapidissiums*) and menhaden (*Brevoortia tyrannus*) on the Atlantic coast. Other migrating forms include the carnivorous striped bass (*Roccus saxatillis*).

In spite of the low diversity and biomass of organisms in the oligohaline systems, they are relatively highly productive due to the constant influx of organic matter via rivers from the land.

5. Mangroves

The mangrove ecosystem occurs sparsely along the U.S. southeast coast. Shaw and Fredine (1971) indicate a northern extremity in Florida of approximately 10,117 hectares (25,000 acres) in the Cape Canaveral area. The remaining mangrove in this region is restricted to the southern extremity of Florida.

Humm (1973) has summarized available literature on the mangrove ecosystem of Florida. Three species of mangrove trees, red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), and white mangrove (*Laguncularia racemosa*) dominate the mangrove communities; buttonwood (*Conocarpus erecta*), although not a true mangrove, is important in the transition zone between the swamp and upland vegetation.

The different species of mangrove trees sometimes grow in randomly mixed associations, but usually different species dominate certain bands or zones which are clearly delimited from the others. This characteristic zonation pattern results from differences in rooting and growth of seedlings and from various competitive advantages which each species has in the several gradients present from below the low water to above the high water lines. Red mangrove seedlings sprout in marl soil below the low tide level; these form the most seaward band. This species may be easily recognized by its arching prop roots and by the long slender seeds which germinate before dropping from the tree. The prop roots are the most important attachment surfaces for sessile organisms in the intertidal region. The mature red mangrove is found inland, on slightly higher intertidal peat soil; the prop roots of these trees are inundated by almost every high tide. The zone inland is composed of black mangrove trees which grow on flat areas flooded by the higher tides. Black mangrove has characteristic pneumatophores. Large numbers of these slender appendages grow up from the main roots until they emerge from the mud. Still further inland, buttonwood swamps and blackrush (*Juncus roemerianus*) marshes form the transition band between the mangroves and either the tropical forest trees or the sawgrass (*Mariscus jamaicensis*), plants that are unable to survive significant amounts of salt. White mangrove is found in all zones but is usually not the dominant species; it is often most abundant near the brackish marshes between the black mangrove and buttonwood swamps.

The mangrove trees are the dominant producers in the swamps, but algae are also important, especially because their production may be much more quickly consumed by the mangrove fauna than the woody materials produced by the trees. In Florida, open shoal areas below mean low water are often covered by tropical species such as *Caulerpa*, *Acetabularia*, *Penicillus*, *Gracilaria*, *Halimeda*, *Sargassum*, and *Batophora* (Davis, 1940 and Taylor, 1954). Above this region, on the intertidal muds, one may find a thick growth of *Vaucheria* or *Cladophoropsis* (Taylor, 1954). There is also a subterranean algal flora composed of unicellular and filamentous blue-green and green

algae (Marath, 1965). Many species of animals are found in mangrove swamps, in sharp contrast to the low diversity of plant species. The most important benthic marine animals are probably crustaceans and mollusks and most of these can be classified as either deposit or filter feeders. Fiddler crabs (Uca spp.) are frequently dominant in terms of biomass (Golley et al., 1962). The crabs on intertidal flats of mangrove islands in Florida bay include *Uca pugilator*, *U. speciosa*, *U. thayeri* and *Eurytium limosum*; other species, *Aratus pisonii*, *Sesarma curacaoense*, and *S. reticulatum* are abundant in mangroves above high water (Tabb et al., 1962). Barnacles such as *Balanus eburneus* attach to roots and stems where they can filter their food from the water at high tide. Coon oysters (*Ostrea frons*), also important filter feeders, are abundant on mangrove roots in Florida and the weight of their shells may eventually cause the root to break off. The dead shells and undigested food of these barnacles and oysters contribute to the sediments of the swamp. Several kinds of snails (*Cerithium*, *Melogena*, *Cypraea*, and *Littorina angulifera*) feed on material deposited on the roots or on the mud surface (Davis, 1940 and Tabb et al., 1962). Some vertebrates of the Florida swamps include turtles, crocodiles, alligators, bears, wildcats, puma and rats (Davis, 1940). Birds are discussed below. Other important consumers in Florida swamps are amphipods, isopods, the crab *Rhithropanopeus harrissii*, and fishes, especially *Cyprinodon variegatus*, *Mollinesia latipinna* and *Floridichtys carpio*.

Birds are abundant, conspicuous, and probably important in mangrove swamps. Approximately half of the species utilize the swamps for nesting activities and the others feed there or congregate there in large communal roosts. The food resources of the birds are varied. Many (egrets, herons, ibis, ducks, kingfishers, crab hawks, stilts, and pelicans) feed on estuarine fishes and invertebrates, and others (fly-catchers, woodpeckers, wrens, and blackbirds) feed on seeds outside the swamps but return for roosting or nesting. The mangroves and their fruits, however, do not directly supply nutriment to birds, and their food supply, like that of the other animals, comes predominantly from marine life in the channels or on the mud flats. The dense nesting colonies in some areas may physically harm the trees, but the excreta is probably of some benefit.

Florida mangrove swamps also serve as nursery grounds for many animal species of economic importance—menhaden, black mullet, spotted sea trout, snook, tarpon, red drum, mangrove snapper, pompano, and pink shrimp. Edible oysters growing on the bottoms of shallow bays or on the mangrove prop roots are also harvested in some areas.

6. Salt Marsh

Salt marshes are typically intertidal beds of rooted vegetation extending from somewhat above the low tide level to supratidal levels inundated only by extreme tides on low energy beaches. They occur along the margins of estuaries, gradually intergrading into freshwater marshes at upstream locations.

The salt marshes of the U.S. southeastern states have been the subject of considerable study, and in general represent the best development of salt marshes in the United States. Spinner (1969) has summarized the acreage of the salt marshes of the coast from North Carolina to Florida (Table F-2). Visual Nos. 4N-4S indicates salt marsh distribution for this region.

A voluminous amount of data is available on the floral components of the salt marshes of this area. Representative studies include those of Reed (1947), Bourdeau and Adams (1956), Adams (1963) and Cooper and Waits (1973). Cooper (1974) provided a detailed account of the typical species composition of salt marshes from which much of the following information is taken.

Behind the outer banks of the southeastern states, fringing the inner shores of the brackish sounds, irregularly flooded marshes occur. Here tidal amplitudes are very limited and often there are rather great changes in salinity of the ground and flooding water. In these marshes, the tidal amplitudes are usually less than a 0.3m (1 ft.) and higher tides are wind-driven and are associated with storms and rapid changes of wind direction and velocity. In these marshes smooth cordgrass (*Spartina alterniflora*) seldom occurs in extensive stands and is generally found fringing the edge of rather straight tidal creeks.

There are two major community types in these marshes (Waits, 1967). Black needlerush occurs in vast, pure stands lying at an elevation just above the mean high water level. There are almost 40,469 ha (100,000 acres) of this type of marsh in the counties fringing Pamlico Sound, North

Table F-2 Coastal Salt Marshes of the Southeastern States

	North Carolina	South Carolina	Georgia	Florida
Juncus roemerianus	100,450 ac (40,651 ha)	91,000 ac (36,826 ha)	74,850 ac (30,291 ha)	76,500 ac (30,959 ha)
Spartina alterniflora	58,400 ac (23,634 ha)	345,000 ac (139,617 ha)	285,650 ac (115,599 ha)	41,200 ac (16,673 ha)
Est. destroyed (1954-1968)	14,700 ac (5,949 ha)	2,000 ac (809 ha)	2,700 ac (1,093 ha)	25,500 ac (10,320 ha)

Source: Spinner, 1969.

Carolina, and the vast majority of this is *Juncus roemerianus* marsh. Few other species occur in this marsh type. On slightly higher ground, along the edge of creeks or at the heads of creeks where sand may accumulate, *Baccharis halimifolia*, *Borrichia frutescens*, and *Spartina cynosuroides* may occur. The other community type is dominated by *Spartina patens*, and resembles the salt meadows of New England marshes. Here, *Spartina patens* forms extensive stands overlying several inches of raw, brownish peat. *Distichlis spicata*, *Scirpus robustus* and *Pluchea purpurascens* are scattered throughout, but these rarely become dominant. Locally, wet openings and ponds occur in these meadows. These form favorite feeding sites for over-wintering waterfowl and, during the summer, for wading and shore birds.

Variations in habitat factors in these marshes are less clearly associated with community types than in some other salt marshes (Waits, 1967). Although there is little apparent difference in elevation, the species maintain the same general spatial relationships found in the low marsh. *Spartina alterniflora* is confined to the intertidal creek banks with *Juncus roemerianus* occurring slightly higher just above mean high water. *Spartina patens*, in general, is slightly higher than *Juncus roemerianus*. The ponds, occurring in the *Spartina patens* zone, are often lower than the surrounding vegetation which permits water to accumulate. Usually the standing water is fresh to brackish. Occasionally, salt water may penetrate into a pond. When penetration occurs, stands of *Spartina alterniflora* and *Salicornia* sp. develop, with much initial establishment of *Spartina alterniflora* from seed. The consequent vegetation is greatly different from that of the brackish ponds. The substratum appears to be a uniform, unsorted sand and the elevational differences in the surface communities reflect elevational differences in the original surface of the sand. With the exception of the salt ponds, where salinities often greatly exceed sea strength, the highest salinities are in the *Juncus roemerianus* zone. Salinity is considerably less in the *Spartina patens* areas. Standing water is present in the *Juncus roemerianus* areas only as a result of wind-driven tides. Drainage is otherwise good. In *Spartina patens*, on the other hand, rainwater may accumulate at any time, but particularly in late fall-winter and in mid-summer. This zone often becomes completely dry in early summer or autumn.

From Cape Lookout, N. C., south to the Jacksonville, Fla. area, the optimum development of salt marsh in the United States is found (Linton, 1968). These marshes, often called low marshes, form behind narrow barrier islands in areas influenced by heavy silt deposition from large rivers. There is a relatively small amount of open water behind the barrier islands. Tidal amplitudes are variable, ranging from 0.6-1.5 m (2-5 ft.) in North Carolina and northern Florida, to as much as 2.4 m (8 ft.) in Georgia and South Carolina. Although marshes throughout this entire region are similar, those from Cape Lookout to Myrtle Beach, S. C., are somewhat less extensive and well-developed than those from Myrtle Beach to Jacksonville. This latter area includes the famous Sea Islands of South Carolina and Georgia.

The characteristic feature of these marshes is the vast expanse of smooth cordgrass (*Spartina alterniflora*) which covers the soft, grey sediments between mean sea level and approximately mean high water. These broad, nearly level expanses of grass and soft sediment develop under the influence of high tidal amplitudes, dendritic creeks and deep tidal channels in vast number, giving the marshes a characteristic dissection pattern when viewed from the air. The slow, gentle subsidence of these South Atlantic marshes also contributes to formation of these intricate creek patterns.

Several distinct community types may be recognized within the South Atlantic salt marshes (Reed, 1947; Kurz and Wagner, 1957; Teal, 1962; Adams, 1963). Although these are reasonably well-defined and characterized by a clear combination of physiographic and biotic features, they actually grade into one another so that the marsh is in reality a series of communities which change gradually from the tidal creeks to higher ground.

Few data are available on the general proportions of the different communities in a given area of marsh. At Sapelo Island, Georgia (Teal, 1962), 20% of the marsh was creek-bank and tall *Spartina alterniflora*, 35% medium *Spartina* and 45% short *Spartina* and *Salicornia*. In Brunswick County, N. C., 6% of the area was tall *Spartina alterniflora*, 11% medium, and 47% short. *Juncus roemerianus* occupied 9% of the area and creeks 27%. No estimate of creek banks was made. Despite the differences in methods and communities recognized, these data do demonstrate that any given large area of marsh is almost half short

Spartina alterniflora and that the creek bank and tall *Spartina alterniflora* zone is less than 20% of the total area. Further, they suggest that farther northward the proportion of short *Spartina alterniflora* increases relative to the other *Spartina* community types.

Despite the complexity of zonation patterns in salt marshes, they are real and definable in specific cases. The overwhelming dominance of one or a few species within zones simplifies the problem of measuring net productivity (Roberts, 1974). Basically two kinds of information are necessary to calculate productivity: the real extent of each marsh zone, and an estimate of the net production of the dominant species/unit area for each marsh zone.

Schelske and Odum (1961) estimated that in salt marshes adjacent to Sapelo Island, Georgia, the marsh grass productivity represented 66-75% of the total productivity of the estuary. Phytoplankton contribute little or nothing in this ecosystem on an annual basis, although they may be a significant source of energy during certain seasons Teal (1962) estimated that 55% of net production is utilized within the marsh, the remaining 45% being exported to the open water portion of the estuary.

A considerable amount of data on salt marsh faunal species has been documented by several authors. However, data summarized by Lynch (1968), Sprunt (1968), Cooper (1974) and Johnson et al. (1974) provide a good overview of the salt marsh faunal components.

Although the common larger animals of these marshes are well known, the distribution and populations of lesser animals, particularly invertebrates, are poorly understood. The most thorough study is that of Teal (1962) which summarizes work done by a number of investigators on Sapelo Island, Georgia. Davis and Gray (1966) give data for insect populations in marshes in the vicinity of Beaufort, North Carolina. The salt marsh grasshopper (*Orchelimum fidicinium*) and the salt marsh plant hopper (*Prokelisia marginata*) are the two major herbivores. *Orchelimum* consumes smooth cordgrass tissues and *Prokelisia* sucks cordgrass juices. These and other less numerous insects support spiders, wrens and sparrows. Relatively speaking, a low proportion of the total energy flow of the marsh moves through the grazing, herbivore-based food chain. A much larger group of organisms lives at or near the mud surface feeding on organic detritus, formed by bacterial decomposition of *Spartina alterniflora*, and on algae. *Spartina alterniflora* stems are broken down by bacteria. These reduce the total amount of organic matter present but increase its food value (de la Cruz, 1965). The most conspicuous algae-detritus feeders are fiddler crabs (genera *Uca* and *Sesarma*), horse mussels (*Modiolus demissus*), and the salt marsh periwinkle (*Littorina irrorata*), in addition to a variety of annelid worms, oligochaetes and insect larvae. These, in turn, may be eaten by mud crabs (*Eurytium limosum*), clapper rails (*Rallus longirostris*) and raccoons (*Procyon lotor*). These relationships are evident in smooth cordgrass-dominated areas. Little is known of the animal populations and feeding relationships in the *Juncus roemerianus* marsh except that insect populations are much more meager than in *Spartina alterniflora* areas (Davis and Gray, 1966).

In addition to the animals of the marsh proper, a great variety of immature and mature fish and shellfish are found in the tidal creeks and shallow waters associated with the marsh. Mature oysters (*Crassostrea virginica*), clams (*Mercenaria mercenaria*), blue crabs, larval and mature shrimp of several species, and the juvenile and mature forms of many fish such as flounder, bluefish, menhaden, croaker and tarpon are commonly found in the creeks. De la Cruz (1965) showed that a number of these species, plus other estuarine fish such as *Fundulus* spp. *Gambusia affinis*, *Mugil* spp., had particulate detritus of salt marsh origin in their guts.

The harshness of the salt marsh habitat restricts the number of resident mammals to a few species. Raccoons are one of the most abundant mammals, and marsh rabbits are common along the edges of the marsh adjacent to high ground. Mink and otter occur in the marsh, but both of these carnivores are seen infrequently. The rice rat is common along the levees of tidal creeks.

The mammals occurring in the salt marshes are primarily carnivorous with the exception of the marsh rabbit. Raccoons are known to feed heavily upon fiddler and squareback crabs (*Uca* spp. and *Sessarma* spp.) two of the most abundant animals in the marshes. Teal and Teal (1969) stated that clams and crabs comprise the principal food organisms of the marsh mink in the fall. The rice rat also feeds primarily on fiddler and squareback crabs and larvae of the rice borer with other in-

sects occurring as incidental food items (Sharp, 1962).

Kale (1965) stated that three species of birds were intimately associated with the salt marsh community in coastal Georgia. These included the long-billed marsh wren, the clapper rail and the seaside sparrow. Sprunt (1968) discussed several other species of birds associated with the marsh. This list was comprised of egrets, herons, rails, shorebirds and passerine species. Several bird rookeries are located in the salt marsh ecosystem (Visual Nos. 4N-S).

The salt marshes (not including potholes and tidal streams) have limited appeal as feeding areas for most species of waterfowl. Lynch (1968) stated that the "true worth of the southern tidal marsh lies not so much in its direct appeal to waterfowl, but rather in its subtle contributions to waterfowl in salt marshes are mainly animal forms. In tidal creeks and potholes, widgeon-grass, a submerged aquatic, is the most important duck food. Most dabbling and diving ducks utilize this plant. The black duck, the most common duck using the salt marsh, feeds primarily on snails. Many species of waterfowl use areas within the salt marsh as resting and loafing areas (Teal and Teal, 1969).

The open waters of the tidal creeks are especially attractive to diving ducks and other birds preferring animal foods. Pied-billed grebes, red-breasted and hooded mergansers, and large numbers of scaup commonly feed in the tidal creeks.

At low tide the exposed mud flats of the tidal creeks and marshes are preferred feeding areas for many species of shorebirds such as willets and greater yellowlegs.

7. Freshwater Marsh

Freshwater marshes occur primarily near the mouths of larger mainland streams and they may extend for some distance up the rivers before being replaced by cypress-gum or hardwood swamps. Much of the area in the southeastern coastal plain now covered by freshwater marsh was cypress swamp before it was cleared and diked for rice culture. Shallow freshwater marshes contain a variety of species including cattails, several bulrushes, smartweeds, aneilema, arrowhead, arrow arum, and others. The deeper freshwater marshes are more extensive. In many areas this marsh type is comprised almost exclusively of giant cutgrass. Stands of sawgrass occur intermittently. Around the deeper margins of the marsh, stands of cattail are common and wild rice occurs in sporadic stands. In the deeper creeks and potholes, submersed and floating-leaved plants are dominant.

As salinities increase to brackish conditions (about 0.5-2 ppt), giant cutgrass is replaced primarily by big cordgrass and, to a lesser extent, by salt marsh bulrush (Johnson, et al., 1974).

Freshwater marshes basically consist of tidal fresh water and non-tidal fresh water. Tidal fresh water marshes are divided into two types based on shallow and deep water depths. The principal type of deep fresh water marsh in the coastal areas is the giant cutgrass marsh, which occurs along the larger streams that are subject to daily tidal effects. These marshes extend inland from the coast up the rivers for several miles in some instances. In general, vegetative species consists primarily of cattails, wildrice, pickerelweed, giant cutgrass and spatterdocks, often accompanied by pondweeds and other submerged growths in marsh openings. This marsh type is limited to South Carolina and Georgia in the south Atlantic region.

The shallow fresh water marshes are generally located along the larger streams in those portions which are also subject to daily tidal effects. Shallow fresh water marshes are distinguished from the deep fresh water marshes on the basis of their shallow water and vegetative composition (bid cordgrass, maidencane, sedges, rushes, etc.). These marshes occur predominantly in North Carolina in this analysis area.

Two accounts consider this ecosystem as a unit in this area of interest. Shaw and Fredine (1971) indicate that approximately 160,000 acres (64,750 ha) of shallow and deep fresh water marshes occur in the southeast coastal zone of which 45,000 acres (18,211 ha) are in North Carolina, 80,000 acres (32,375 ha) in South Carolina, 30,000 acres (12,141 ha) in Georgia and 5,000 (2,023 ha) in Florida.

These coastal wetlands and associated bodies of open water are very important to numerous species of waterfowl. Of particular importance are the freshwater marshes, where most developments for the management of ducks are found. Undeveloped cutgrass marshes are used primarily during peak flights in the fall months. While the tidal rivers associated with the fresh water marshes offer little in the way of food organisms,

they are nevertheless valuable in attracting waterfowl which utilize the adjacent freshwater ecosystem. The ecosystem is used most by the puddle ducks (mallards, teals, pintails, widgeons, etc.) (U.S. Dept. of Interior, 1973).

Other representative wildlife species include passerine birds, raccoons, rabbits and small predators. In addition, several freshwater fish as well as some marine fish species utilize the freshwater marsh ecosystem.

G. Human Utilization

1. Transportation

a. PORT FACILITIES

There are seven major commercial ports within the U.S. South Atlantic region. The three smallest of these are located at Morehead City, N.C.; Georgetown, S.C.; and Brunswick, Ga. The other four which have oil storage facilities in excess of five million barrels, are located in Wilmington, N.C.; Charleston, S.C.; Savannah, Ga; and Jacksonville, Fla. The larger of these ports are served by 11.6 to 12 m depth (38 to 40 ft) channels and the smaller by channels of 10.6 m (35 ft) or less. Table G-1 summarizes the key elements of each of these ports, north to south. Other ports include Canaveral, Palm Beach, Port Everglades, and Miami, Fla. Freight traffic tonnage for these and the aforementioned seven ports is summarized in Table G-8.

The port of Morehead City, N.C., is on a peninsula extending easterly from the mainland between Bogue Sound and Calico Creek. The port is 247.8 km (154 nautical miles) northeast of Wilmington, N.C., and 400 km (249 nautical miles) south of Norfolk, Va. (U.S. Dept. of the Army, 1971).

The deepwater approach from the Atlantic Ocean to the port is via a dredged channel across the bar and through Beaufort Isles. The channel extends to a Y-shaped turning basin. Beaufort Inlet, about midway between Cape Hatteras and Cape Fear, is approximately 35.4 km (15 mi.) westward along the coast from Beaufort Inlet to Bogue Inlet. It is separated from the ocean by Bogue Banks.

The route of the Atlantic Intracoastal Waterway passes through Morehead City harbor. The Corps maintains a bar channel of 10.6 m (35 ft.) deep and 121.9 m (400 ft.) wide through Beaufort Inlet, increased to 182.8 m (600 ft.) wide at the bend; thence an inner channel 10.6 m (35 ft.) deep and 91 m (300 ft.) wide.

Twenty-four piers, wharves and docks comprise the port of Morehead City. Five of these facilities are for deep-draft vessels and are located on the turning basin; the remaining 19 waterfront facilities are for use of fishing boats, barges and other types of small vessels.

Three of the waterfront facilities are equipped to receive and/or ship petroleum products and asphalt; one of the facilities provides bunkering service to vessels.

The Port of Wilmington, N.C., is in the southeastern part of the State, 242 km (154 naut. mi.) southwest of Morehead City, N.C. The port's principal waterfront facilities are along the city's waterfront on the east banks of the Cape Fear and Northeast Cape Fear rivers; the junction of the two rivers is at Wilmington, about 45 km (28 stat. mi.) above the mouth of the Cape Fear River (U.S. Dept. of Army, 1971a).

The mouth of the Cape Fear River is about 8 km (5 mi.) west of Cape Fear, between Smiths Island on the east and Oak Island on the west. The deep-water approach from the Atlantic Ocean to the port is via a dredged channel across the bar and upstream to Wilmington.

The Corps maintains a 12 m (40 ft.) channel from the ocean to Southport, and 11.5 m (39 ft.) from Southport to Wilmington harbor. Above Wilmington there is a 7.6 m (25 ft.) draft channel for 48 km (2.9 mi.) to Navassa and 3.6 m (12 ft.) from there for 18 km (30 mi.) to Acme.

Forty-one piers, wharves and docks are located in the port of Wilmington. Nine of the waterfront facilities are equipped to receive and/or ship petroleum products, petrochemicals and asphalt. One of the facilities provides bunkering services to vessels; one oil company can bunker tankers while berthed at its facility; and four facilities are equipped to fuel towboats and other types of small vessels.

The Port of Georgetown, South Carolina is located along the north bank at the mouth of the Sampit River, which empties into the head of Winyah Bay from the northwest. The port is about 22 km (14 naut. mi.) from the Atlantic Ocean, 127 km (79 naut. mi.) northeast of Charleston, S.C., and 173 km (108 naut. mi.) southwest of Wilmington, N.C. (U.S. Dept. of the Army, 1970).

Winyah Bay extends about 25.7 km (16 mi.) from the ocean to the confluence of the Pee Dee and Waccamaw rivers at its head near Georgetown, S.C. The deepwater approach to the port is via a dredged 8.2 m (27 ft.) channel leading from the ocean through Winyah Bay and Sampit River to a turning basis at the western end of the harbor.

Waterfront facilities exist for deep-draft vessels and the principal waterborne commodities handled at the port are pulpwood, paper, steel and petroleum products. The route of the Atlantic Intracoastal Waterway passes through Winyah Bay.

Table G-1. Port and Harbor Facilities in the U.S. South Atlantic Coastal States.

	Morehead City, N.C.	Wilmington, N.C.	Gerogetown, S.C.	Charleston, S.C.	Savannah, Ga.	Brunswick, Ga.	Jacksonville, Fla.
Channel Depth Meters (ft.)	10.6 (35)	11.5 (38)	8.2 (27)	10.6 (35)	12 (40)	9.7 (32)	11.5 (38)
Number of Piers, Wharves and Docks	24	41	16	54	51	19	82
Number of Oil Handling Facilities	3	9	1	8	13	4	18
Oil Storage Tank Capacity (000 bbls.)	1191	5262	188	6043	5430	480	6630
Waterborne Commerce 1972 (short tons)	1423	7590	1524	7477	8037	1263	14,886

Source: Virginia Institute of Marine Science (VIMS), 1974.
A Socio-Economic Environmental Baseline Summary for the South Atlantic Region Between Cape Hatteras, N.C. and Cape Canaveral, Fla. Volume V, Socio-Economic Inventory.

Table G-8. Water Movement of Freight Traffic for Selected Ports Along the Southeastern Coast of the U.S., 1973. (thousands of short tons)

Harbor	Total	Foreign		Coastwise		Internal		Local
		Imports	Exports	Receipts	Shipments	Receipts	Shipments	
1. Morehead City, N.C.								
Total	1,161	307	386	290	2	66	110	0
(SIC 13,29)	521	175	0	212	0	64	70	0
2. Wilmington, N.C.								
Total	9,301	4,083	216	2,942	86	132	1,776	66
(SIC 13,29)	5,917	2,657	0	2,249	22	11	913	65
3. Georgetown, S.C.								
Total	1,486	339	152	29	7	944	13	0
(SIC 13,29)	356	317	0	29	0	10	0	0
4. Charleston, S.C.								
Total	9,380	3,781	1,071	3,281	307	141	686	113
(SIC 13,29)	6,269	2,391	1	3,040	9	78	644	106
5. Savannah, Ga.								
Total	8,980	4,052	1,766	2,144	223	100	207	487
(SIC 13,29)	4,247	2,012	7	1,493	220	3	29	484
6. Brunswick, Ga.								
Total	1,394	721	47	2	6	312	202	104
(SIC 13,29)	530	129	0	0	0	296	1	104
7. Jacksonville, Fla.								
Total	15,514	6,206	1,864	4,511	877	117	1,829	110
(SIC 13,29)	10,166	4,113	2	4,120	30	0	1,796	107

Table G-8 (continued)

Water Movement of Freight Traffic for Selected Ports Along the Southeastern Coast of the U.S., 1973. (thousands of short tons)

Harbor	Total	Foreign		Coastwise		Internal		Local
		Imports	Exports	Receipts	Shipments	Receipts	Shipments	
8. Canaveral, Fla.								
Total	2,363	1,461	4	205	0	4	688	0
(SIC 13,29)	1,943	1,058	0	201	0	0	684	0
9. Palm Beach, Fla.								
Total	1,284	957	204	77	39	5	2	0
(SIC 13,29)	815	808	3	0	0	2	1	0
10. Port Everglades, Fla.								
Total	12,542	4,763	225	6,430	967	129	29	0
(SIC 13,29)	10,443	3,024	11	6,308	945	127	28	0
11. Miami, Fla.								
Total	5,569	1,700	494	474	171	59	1,366	1,305
(SIC 13,29)	4,244	1,185	5	338	19	28	1,364	1,305

Source: U.S. Department of Army, U.S. Corps of Engineers, 1973.

The port consists of 16 piers, wharves and docks. Only one of the waterfront facilities receives petroleum products, and in an emergency or by special arrangement, bunkering service for large ocean-going vessels can be provided. The Hess Oil and Chemical Division, Amerada Hess Corporation, operates an offshore-type wharf owned by the South Carolina State Ports Authority. Two pipelines, one 30 cm (12 in.) and one 25 cm (10 in.), extend from the wharf to four steel storage tanks in rear; these tanks have a total capacity of 188,000 barrels.

The Port of Charleston, South Carolina: is on a peninsula at the confluence of Cooper River on the east and the Ashley River on the west. The rivers flow into the bay known as Charleston Harbor. The port is 127 km (79 naut. mi.) southwest of Georgetown, S.C., and 164 km (102 naut. mi.) northeast of Savannah, Ga. (U.S. Dept. of the Army, 1970).

The deepwater entrance from the ocean to the port is via a 10 m (35 ft.) dredged channel between two stone jetties lying outside Sullivans Island on the northeast and Morris Island on the southwest.

The United States Navy dredged a 10 m (35 ft.) channel with varying widths between the mouth of Goose Creek and a point about 7.7 km (4.8 mi.) upstream. Charleston Harbor forms part of the route of the Atlantic Intracoastal Waterway.

Fifty-four piers, wharves and docks make up the port facilities of Charleston. Eight of the waterfront facilities are equipped to receive and/or ship petroleum products, petrochemicals, asphalt, or to load a tank barge at the port for bunkering vessels at berth; seven are along the right bank of the Cooper River, and one is on the right bank of the Shipyard River.

The Port of Savannah, Georgia is located on the right bank of the Savannah River; about 24 km (15 mi.) from the Atlantic Ocean. Savannah is the second largest city and chief port of the State. The port is 164 km (102 naut. mi.) south of Charleston, S.C. and 233 km (145 naut. mi.) north of Jacksonville, Fla. (U.S. Dept. of the Army, 1972).

The deepwater entrance from the ocean to the mouth of the river is via a 15.4 km (9.5 mi.) long, dredged channel across the bar through Tybee Roads. The Port's principal waterfront facilities are located along the right bank of the river.

The route of the Atlantic Intracoastal Waterway crosses the Savannah River. Fifty-one piers, wharves and docks are described in this report for the port of Savannah. Thirteen of the waterfront facilities described above this are equipped to receive and/or ship petroleum products; 12 are along the right bank and one is on the left bank of the Savannah River on Hutchinson Island. Two of the wharves provide bunkering service to vessels.

The Port of Brunswick, Georgia is 131.9 km (82 naut. mi.) north of Jacksonville, Fla. and 167 km (104 naut. mi.) south of Savannah, Ga. The harbor includes a 9.7 m (32 ft.) dredged channel across the ocean bar to the entrance of St. Simon Sound (U.S. Dept. of the Army, 1972). Nineteen piers, wharves and docks are listed for the port of Brunswick, Ga. Four of the waterfront facilities described are equipped to receive and/or ship petroleum products. The Eastern Seaboard Petroleum Company, Inc. provides bunkering service for large ocean-going vessels berthed at the Brunswick Port Authority Lanier Dock and the Georgia Ports Authority, Brunswick State Docks. This company owns and operates five tank barges. These barges are based at the port of Jacksonville, Fla., with cargo-carrying capacities ranging from 4,200 to 11,000 barrels.

The Port of Jacksonville, Florida is on the St. Johns River 233 km (145 naut. mi.) south of Savannah, Ga. and 555 km (345 naut. mi.) north of Miami, Fla. The deepwater entrance from the ocean to St. Johns River is between jetties which extend in an east-west direction across the ocean bar from the river's mouth. Eighty-two piers, wharves and docks are provided in the port of Jacksonville. Eighteen waterfront facilities are equipped to receive and/or ship petroleum products and to provide bunkering service to vessels. Large, ocean-going vessels are usually bunkered at berth by tank barges.

Table G-8 provides a summary of the water movement of freight traffic for selected ports along the southeastern coast of the U.S. during 1973. The data are shown for total freight tonnages, and tonnages of crude petroleum and petroleum products (SIC 13 and 29). The data were compiled from U.S. Department of the Army, 1973b.

Table G-9 summarizes traffic volumes for waterborne commerce, and petroleum and products shipping at selected ports and waterways.

Table G-9. Petroleum and Petroleum Products Freight Traffic - 1972.
Selected Other Harbors & Waterways (in thousands of short tons).

PORT/WATERWAY	Total Volume All Shipping	Residual Fuel Oil	Gasoline	Jet Fuel	Kerosene	Distilled Fuel Oil	Coke Petroleum Coke
Pamlico & Tar Rivers, N.C. domestic	559	33	-	-	-	-	
Neuse River, N.C. domestic	476	78	32	12	6	12	
Atlantic Intracoastal Waterway (Wilmington District) domestic	2,796	429	124	120	29	66	32
Cape Fear River above Wilmington, N.C. domestic	728	499	2	-	12	-	-
Northeast (Cape Fear) River, N.C.	386	56	-	-	-	-	-
Beaufort Harbor N.C.	64	22	-	-	-	-	-
Mantec (Shallowbag) Bay, N.C.	25	-	13	-	2	4	-
Perquimans River N.C.	2	-	1		0.5	0.4	-
Rollinson Channel, N.C.	32	-	2	-	-	1	-
Silver Lake Harbor, N.C.	4	-	0.6	-	-	-	-

Table G-9 (continued)

PORT/WATERWAY	Total Volume All Shipping	Residual Fuel Oil	Gasoline	Jet Fuel	Kerosene	Distilled Fuel Oil	Coke Petroleum Coke
Waterway, Norfolk, Va., to Sounds of N.C.	45	-	10	-	2	-	-
Atlantic Intracoastal Waterway (Charleston District) domestic	1,445	.5	10	111	12	2	32
Atlantic Intracoastal Waterway (Savannah District) domestic	1,353	555		97	12	3	
Atlantic Intracoastal Waterway (Jacksonville District) domestic	1,241	861		97		3	
Rice Cree, Fla.	272	272					
St. John's River, Fla., Jacksonville to Lake Harvey	1,133	945	2	160	1	5	
Intracoastal Waterway Jacksonville to Miami, Fla., Oceangoing	246	125	-	-	-	2	-
Internal	592	525					

Source: VIMS, 1974.

B. TRANSPORTATION SYSTEMS

(1) Ocean Shipping

In order to prevent conflicts between ocean shipping and oil and gas operations a traffic separation scheme has been adopted in certain ocean areas around the United States. In the Gulf of Mexico well defined navigational "fairways" have been established wherein no oil or gas operations may take place. No navigational "fairways" have been established for the U.S. South Atlantic OCS region, (USCG, 1976). The Coast Guard intends to utilize shipping safety fairways (Corps of Engineers—established) and traffic separation schemes (Coast Guard-established) as appropriate to organize shipping safety through development areas if structure numbers warrant. Still, vessels are not and would not be required to use these safety aids (USGS Letter, 1977).

(2) The Intracoastal Waterway

This canal system is a toll free waterway which affords continuing passage behind the Atlantic Coast and the Florida Keys for more than 2029 km (1,243 stat. mi.) between Norfolk, Va. and Key West, Fla. It is used by light draft vessels and tows unable to navigate long stretches in the open ocean (U.S. Dept. of Commerce, 1975).

According to the Department of the Army (1973) a total of 3,877,819 tons of commodities moved along the waterway between Norfolk, Va. and the St. Johns River, Fla. Of this total 1,666,168 tons consisted of petroleum and kindred products.

(3) Pipelines

In the southeastern U.S. coastal region, the only major pipelines are for natural gas. The lack of oil fields in the region and the proximity of port facilities have rendered the transport of crude oil through pipelines unnecessary. The system of pipelines serving and traversing the region is depicted on the accompanying map (Figure G-1).

The pattern of natural gas lines is, for the most part, one of branch lines tapping the Transcontinental Gas Pipeline Corporation's main line in the Piedmont Region, and traversing the Coastal Plains Region in a southeasterly, or easterly, direction toward the coast. Natural gas lines terminate at Brunswick, Savannah, Beaufort, Charleston, Georgetown, Myrtle Beach, Wilmington, New Bern, and Washington. All densely populated and industrial areas are served by natural gas lines. Exclusive of local distributors, six natural gas pipeline companies operate in the Coastal Plains Region; North Carolina Natural Gas Corporation; Piedmont Natural Gas Company; Public Service Company of North Carolina; Carolina Pipeline Company; South Carolina Electric and Gas Company; and Southern Natural Gas Company. These firms transport and/or distribute natural gas originating in Texas, Louisiana, and Oklahoma. Some of these firms both transport and distribute gas. Others transport and turn it over to local companies or local public authorities for local distribution.

Product pipelines are not as extensive in the coastal area. The mileage of pipeline enumerated below (U.S. Department of Interior, Bureau of Mines 1974b) is found generally in the Piedmont region and beyond.

	1971	1974
Florida 15.2 cm to 25.4 cm (6″ to 10″)	140 km (87 miles)	373 km (232 miles)
Georgia 10.1 cm to 60.9 cm (4″ to 24″)	2,780 km (1,728 mi)	3,035 km (1,886 mi)
North Carolina 10.1 cm to 60.9 cm (4″ to 24″)	1,342 km (834 miles)	1,448 km (900 miles)
South Carolina 15.2 cm to 24 cm (6″ to 24″)	1,021 km (635 miles)	1,076 km (669 miles)

(4) Railroads

The two major rail systems serving the southeastern U.S. coastal region are the Southern Railway and the Seaboard Coast Line. Although its main north-south lines are west of the region, the Southern Railway operates several east-west lines which extend to the coast. The Seaboard Coast Line serves the region intensively with both north-south and east-west lines. Passenger service in the region is very limited and continues to decline. However, there is sufficient capacity for freight service on the existing rail network to allow expansion of services which will be required for accelerated economic development related to possible oil and gas production on the OCS.

The Southern Railway owns 10,224 km (6,274 mi.) of track and has its headquarters in Washington, D.C. Although its main lines are west of the Coastal Region, the Southern operates east-west lines from its main lines which extent to Charleston, Savannah, New Bern, and Morehead City.

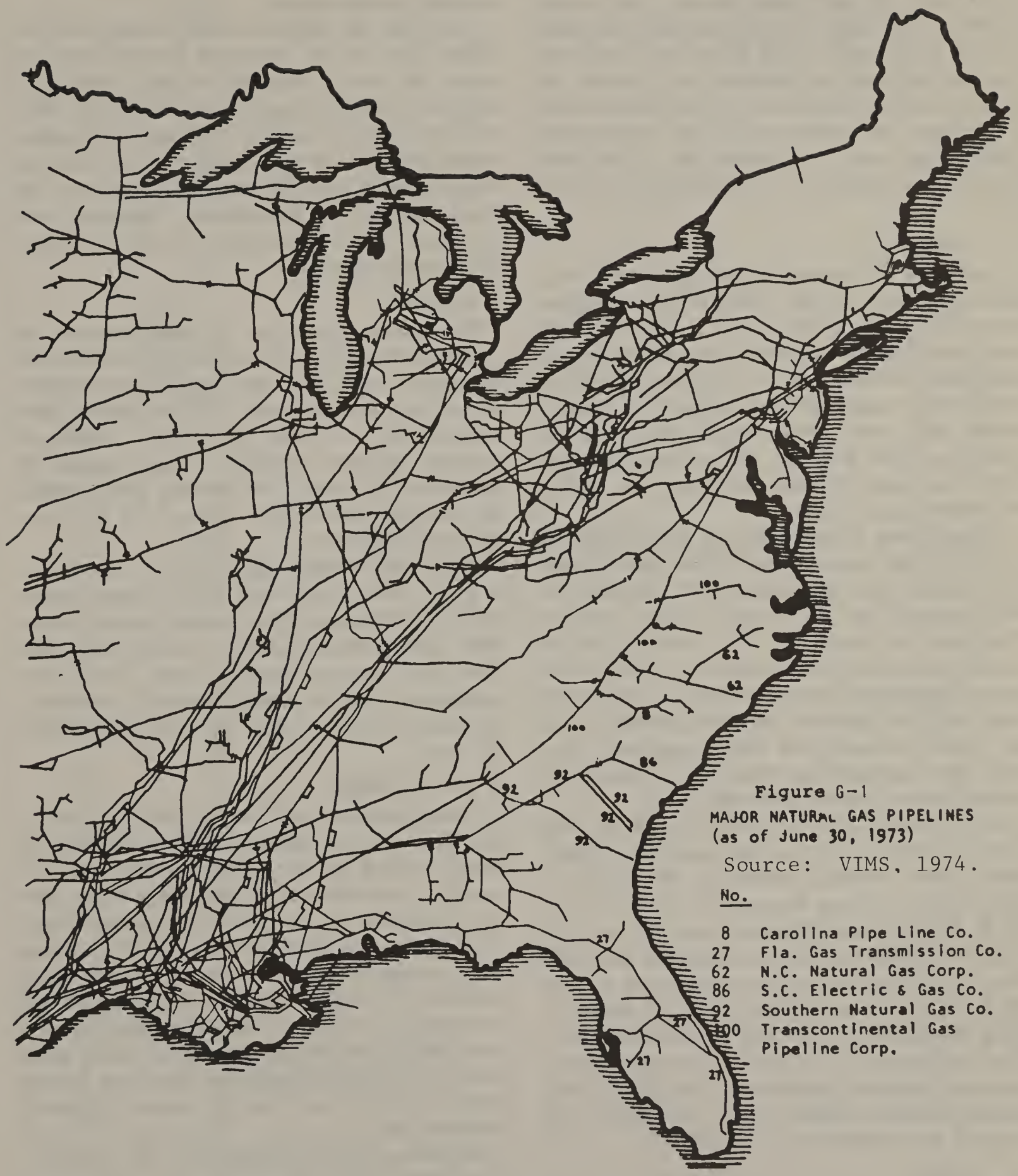


Figure G-1
MAJOR NATURAL GAS PIPELINES
(as of June 30, 1973)

Source: VIMS, 1974.

No.	
8	Carolina Pipe Line Co.
27	Fla. Gas Transmission Co.
62	N.C. Natural Gas Corp.
86	S.C. Electric & Gas Co.
92	Southern Natural Gas Co.
100	Transcontinental Gas Pipeline Corp.

The Seaboard Coast Line owns over 14,646 km (9,000 mi.) of tract and has its executive headquarters in Jacksonville, Fla. This system serves the Region intensively with lines extending to all parts of the Region running both north-south and east-west. The Seaboard also provides service to all major points in Florida, and it extends as far north as Richmond, Va., thereby offering a vital connection to the Northeast. Several small lines are important to the communities which they serve. A complete list of rail lines serving the coastal area is presented in Table G-10.

(5) *Highways*

Less than five percent of the highways, other than Interstate, on the State Primary Systems within the region are four-lane (only 97 km (60 mi.) would qualify as freeway). A very large percentage is two-lane, narrow, with poor alignment. Many urban areas are not bypassed by through traffic, and cause delays which increase travel time from point to point. The accident rates for North and South Carolina and Georgia are among the highest in the nation.

An indication of traffic flow in the coastal area is given on the map of "Traffic Flow in Interstate and United States Highways, 1967" prepared by Wilbur Smith for the Coastal Plains Regional Transportation Study (Fig. G-2). Although not up to date, this map probably presents a fairly accurate representation of traffic flows in the Coastal Zone with the important exception of Route I-95 for which sections have been completed since 1967, and state highways which provide important connections not shown on the map.

Most significant for the coastal zone is the lack of any interstate route in the area above Charleston. From Savannah northward, I-95 moves inland requiring driving distances of 119 to 145 km (73 to 89 mi.) from Wilmington and 189 km (116 mi.) from Morehead City to reach the interstate route. Charleston has a good connection to I-95 via I-26, and all but 42 km (26 mi.) of Route 70 from Morehead City to I-95 is developed as a four-lane highway. This, and the generally sparse system of improved highways in the coastal zone, constitute serious limits to its accessibility for much of its area (Planners, Inc., 1974).

(6) *Airports*

Most passenger traffic in the coastal area is by air, bus or passenger cars. No data on bus or private car travel are available. Air travel plays an increasingly important role in passenger traffic, particularly for longer trips. The air freight services offered are also an important factor in economic development.

There are 69 airports in the coastal zone of which eight provide scheduled airline service. Of these, five can be classified as major airports. A listing of these by county is in Table G-11. Most of these airports could be available for helicopter support which may be necessary for any OCS activity resulting from this proposed lease sale. The major airports of Jacksonville, Savannah, and Charleston may be more likely choices than some of the others listed.

2. Dredging

The marine transport of huge tonnages of materials has led to the development of ports and navigable waterways that could accommodate vessels with greater drafts. The development and maintenance of these ports and waterways requires extensive dredging of large volumes of sediments each year. The principal responsibility for dredging operations is vested with the Army Corps of Engineers.

Each year dredging operations are carried out in major harbors and along the intercoastal waterways. The disposal of the dredged material varies from open ocean dumping sites, diked areas near shore and onshore dumping sites. Table G-12 summarizes the dredging location, frequency, yardage and disposal areas for each South Atlantic State.

3. Ocean Dumping

Ocean dumping under the 1972 Marine Protection Research and Sanctuaries Act is regulated by permits issued by the Environmental Protection Agency. An interim list of approved dumping sites was published in the Federal Register (May, 1973). Table G-13 lists 17 of the approved interim sites located in the South Atlantic coastal region south of 37° N. The approved dumping sites are all within 32 km (20 mi.) of shore. The proposed lease tracts are 48 km (30 mi.) or more from shore. All of the proposed lease tracts are greater than 35 km (22 mi.) from the nearest approved dumping site.

Explosives have been dumped in the South Atlantic OCS in two dumping sites, both presently inactive. These sites are located over 170 km (106 mi.) from shore and approximately 64 km (40 mi.)

Table G-10. Railways Serving the Southeastern U.S. Coastal Region.

Railroad Name	Home Office	Mileage of Rail	Services Offered 1/ P	F	RE	TOFC	States Served
Atlantic & East Carolina	New Bern, N.C.	94		X		X	N.C.
Beaufort & Morehead City	Beaufort, N.C.	3		X	X		N.C.
Central of Georgia	Savannah, Ga.	1,743	X	X	X	X	Ala.,Ga., Tenn.
Cape Fear	Fort Bragg, N.C.	42	X	X		X	N.C.
Camp Lejeune	New Bern, N.C.	30		X		X	N.C.
Savannah & Atlanta	Savannah, Ga.	168		X	X		Ga.
Seaboard Coast Line	Jacksonville, Fla.	9,632	X	X	X	X	Ala.,Fla., Ga.
Southern	Washington, D.C.	6,274	X	X	X	X	Ala., D.C., Fla., Ga., Ill., Ind., Ky., Miss., N.C., S.C., Tenn., Va.

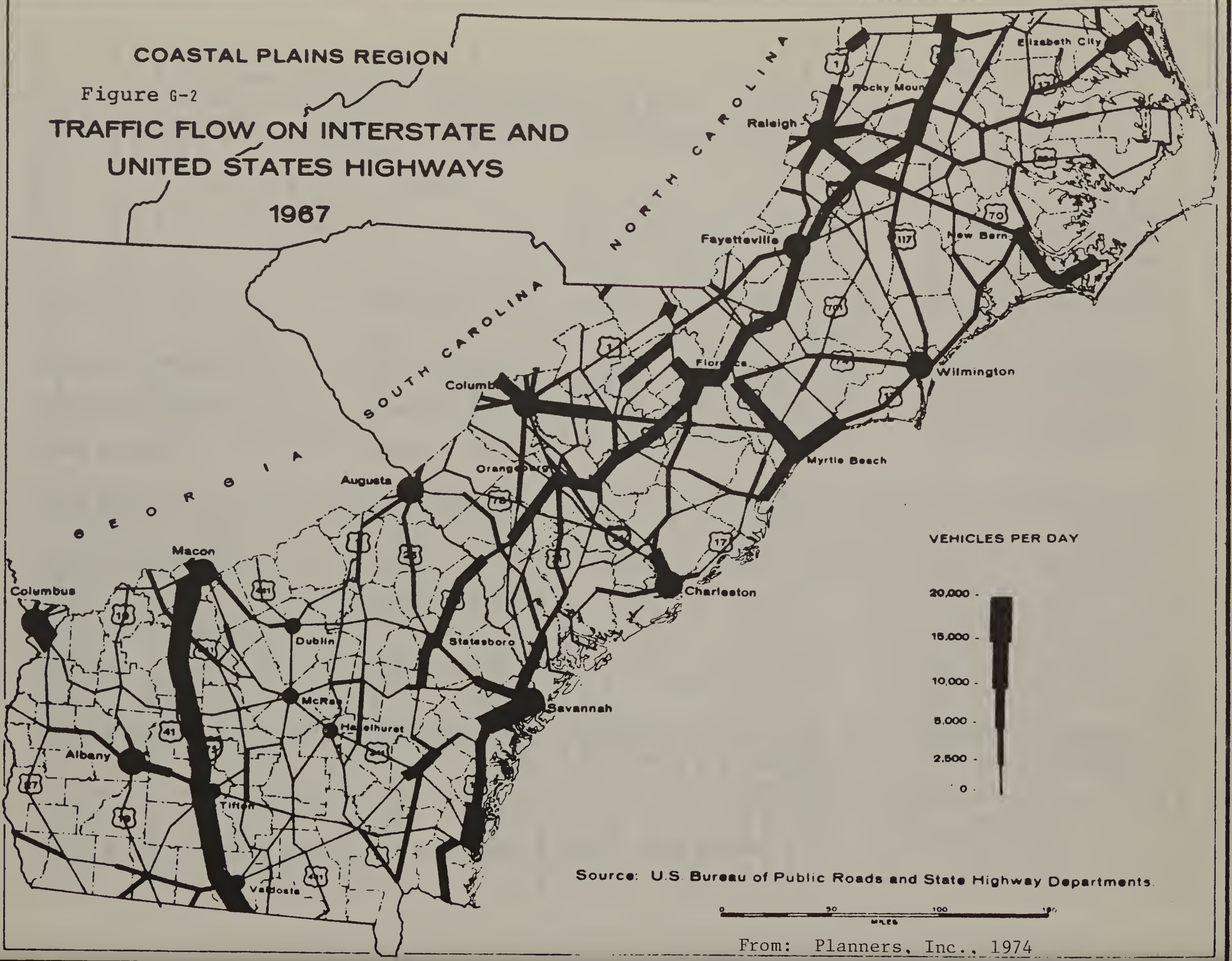
1/ P - Passenger, F - Freight, RE - Railway Express, TOFC - Trailer on Flat Car.
Source: Rand McNally, 1967. Handy Railroad Atlas of the United States.
National Railway Publication Company, 1968. The Official Guide of the Railways.

COASTAL PLAINS REGION

Figure G-2

TRAFFIC FLOW ON INTERSTATE AND UNITED STATES HIGHWAYS

1967



Source: U.S. Bureau of Public Roads and State Highway Departments.

From: Planners, Inc., 1974

Table G-11. Airports in the Southeastern U.S. Coastal Zone.

Location	Non-Commercial	Scheduled	Military
1. NORTH CAROLINA			
Brunswick	1	-	-
New Hanover	1	1 Wilmington*	-
Pender	2	-	-
Onslow	2	1 Jacksonville*	1
Craven		1 New Bern*	1
Carteret	3	-	1
Pamlico	-	-	-
Beaufort	1	-	-
Hyde	2	-	-
Dare	2	-	-
2. SOUTH CAROLINA			
Jasper	1	-	-
Beaufort	3	-	1
Berkley	1	-	-
Charleston	5	1 Charleston*	1 (same as city airport)
Colleton	1	-	-
Georgetown	-	-	-
Horry	2	-	-
3. GEORGIA			
Camden	2	-	-
Glynn	3	1	-
McIntosh	4	-	-
Liberty	2	-	1
Bryan	-	-	-
Chatham	1	1 Savannah*	1
4. FLORIDA			
Brevard	3	1 Melbourne	2
Flagler	2	-	-
Volusia	2	1 Daytona Beach	-
St. Johns	1	-	-
Duval	2	1 Jacksonville*	2
Nassau	1	-	-

*Major

Source: Planners Incorporated, 1974. Coastal Zone Atlas.

Table G-12. Major Dredging Sites in the Southeastern Atlantic Coastal Region

State	Frequency	Yardage	Disposal Location
N. Carolina			
Morehead City	annual	800,000	ocean dump
Wilmington	annual	1 million	ocean dump
S. Carolina			
Georgetown	annual	2.5 million	
Port Royal	"	0.5 "	ocean dumps
Charleston	"	8.5 "	& diked areas
Intercoastal Waterway	"	2 "	
Georgia			
Savannah harbor entrance		1 million	ocean dump
" inner harbor	continuous	6 "	harbor disposal area
Brunswick	6 month		diked
outer portion		700,000	
inner "		800,000	
Atlantic Intercoastal Waterway	continuous	1 million	open marsh
Florida			
Jacksonville Harbor	2 yrs.	500,000	ocean & dike dump
St. Augustine "	annual	100,000	ocean dump
Cape Canaveral "	"	600,000	beach nurishment ocean & dike dump
Ft. Pierce "	5 yrs.	150,000	dike
Palm Beach "	annual	100,000	dike & ocean dump
Miami "	12 yrs.	unknown	beach nurishment dike

Source: U.S. Army Corps of Engineers, 1976.

Table G-13 Approved Interim Dumping Sites - EPA Region IV

Location	Size Square Kilometers (mi^2)	Depth Meters (ft)	Primary Use
Wilmington Harbor 33°48', 78°02'	9.0 (3.5)	14 (45)	Sand and silt (hopper dredge)
Morehead City 34°39', 76°42'	30.0 (11.6)	15 (50)	Do. 1/
Georgetown Harbor 33°11', 79°08'	2.6 (1.0)	8 (28)	Mostly sand and shell
Port Royal Harbor 32°09', 80°36'	3.6 (1.4)	6 (20)	Do.
Port Royal Harbor 32°05', 80°36'	2.6 (1.0)	6 (21)	Do.
Brunswick Bay 31°02', 81°17'	5.2 (2.0)	9-11 (29-36)	Sand with some shell silt
Savannah Bar 31°57', 80°46'	5.2 (2.0)	6-11 (20-36)	Do.
Canaveral Harbor 28°23', 80°34'	4.1 (1.6)	9 (31)	Sand silt
Fernandina Harbor 30°42', 81°22'	0.2 (0.1)	11 (37)	Sand, shell, and mud

(continued)

1/ Ditto

Table G-13 (continued) Approved Interim Dumping Sites - EPA Region IV

Location	Size Square Kilometers (mi^2)	Depth Meters (ft)	Primary Use
Fernandina Harbor 30°42', 81°24'	0.2 (0.1)	10 (33)	Do.
Fort Pierce Harbor 27°27', 80°15'	0.8 (0.3)	12 (39)	Do.
Jacksonville Harbor 30°21', 81°18'	0.8 (0.3)	9 (31)	Sand and shell
Miami Harbor 25°45', 80°05'	0.3 (0.13)	12-21 (41-68)	Do.
Palm Beach Harbor 26°46', 80°01'	13.4 (5.2)	8-17 (26-57)	Do.
Port Everglades Harbor 20°06', 80°06'	0.2 (0.1)	7 (24)	Do.
St. Augustine Harbor 29°54', 81°15'	0.8 (0.31)	11 (36)	Fine sand
St. Lucie Inlet 27°10', 80°09'	0.2 (0.1)	3 (11)	Sand and shell

Source: Federal Register, May 1973.

from the nearest proposed lease tract (Figure G-3).

EPA has issued a permit for dumping chemical industrial wastes to APM Manufacturing Company, Augusta, Georgia. No dumping has as yet taken place on the permit area which is indicated in Figure G-3.

4. Military Use of the Continental Shelf

Figure G-3 (Section II.G.3.) indicates the Fleet Operating Areas. These areas provide controlled territory for testing and training of surface, submarine and air units of the United States Armed Forces. Detailed charts on the Fleet Operating Areas can be found in "Atlantic Fleet Operating Areas Within the Eastern Sea Frontier", COMEASTSEAFRON Instruction 3120.5C of June 28, 1972 Area coverage of the detailed charts are shown on Figure G-4.

Within the South Atlantic OCS region, sea and air space are utilized by Defense Department agencies for military exercises including surface and aerial gunnery, bombing, torpedo firing, air-to-air, air-to-surface, and surface-to-surface missile firing; air combat maneuvering; aircraft carrier operations; and surface ship and submarine training Sonic Booms may be experienced in these areas. Additionally the National Aeronautics and Space Administration through its operations at the Kennedy Space Center utilizes the Atlantic Ocean seaward of the missile launch sites and south of the thirtieth parallel for a buffer area subject to booster cases or aborted launch vehicles. No tracts offered in this proposed lease sale lie south of the thirtieth parallel.

5. Commercial Fishery Resources

In 1975, the total U.S. commercial fisheries landings were 4.8 billion pounds valued at $970.8 million. This was a decrease of two percent in volume but an increase of eight percent in value compared with 1974 (U.S. Dept. of Commerce, 1976). The decline in quantity could be due to decreased catch of low priced finfish, particularly menhaden. Tables G-14 and G-15 summarize the breakdown of total landings for the southeastern Atlantic states and the total for finfish and shellfish for the area, respectively.

Landings in 1975 for the southeastern Atlantic States accounted for seven percent or 300 million pounds and six percent or $61 million of the U.S. catch. The greatest volume of commercial fish landings were finfish, ranging from 74-81% of the total catch, with menhaden comprising from 38-65% of the total volume (Chestnut and Davis, 1975). North Carolina led the states with a catch of 200 million pounds in 1975. Menhaden ranked first and thread herring second in catch for North Carolina.

The shellfish catch increased in volume; however, it decreased in value from 1973. This is partially due to the increase of calico scallops which sold at approximately $0.55 per pound. North Carolina led in total landings for 1975 with 238 million pounds, 73% of the total landings. It also led in value for 1975 with $20 million or 33%.

Menhaden ranked first in volume and total catch for the species landed in the southeastern Atlantic states (Table G-16). Table G-17 indicates the leading species according to price/lb. is the pompano which is landed mostly in Florida but also appears in North Carolina and South Carolina. Roller trawling for red snapper has been recently introduced in South Carolina with six ships currently utilizing this method to trawl the live bottom areas offshore. Since red snapper is a highly priced fish and roller trawling has been shown to be a very productive method of harvest, the usage of roller trawling will probably become more common offshore of the southeastern U.S.

The distribution of Atlantic menhaden in the southeast Atlantic states varies with season. During the warmer months, the fish congregate in schools which are found in greater concentrations in water depths of less than 36 m (120 ft.). Throughout the summer months, the young are confined to estuaries. In late autumn, juveniles and adults are found only off the coast of North Carolina (Roithmayr, 1973). The greatest volume of landings occur during November and December when the menhaden fishery is at its peak (Chestnut and Davis, 1975).

King mackerel, which ranked 9th by weight of commercial landings in 1974 undergoes wide ranging migrations through the proposed lease area.

Tables G-19 and G-20 represent a summary of commercial fisheries for the southeast Atlantic states (U.S. Dept. of Commerce, 1976).

The major shellfish caught along the southeast Atlantic coast are crabs, shrimp, oysters, scallops and spiny lobsters. In 1974, there was a total of approximately 74 million pounds caught which was valued at $31 million (U.S. Dept. of Commerce, 1976). The 1973 figures were approximately 65 million pounds valued at $39 million. There

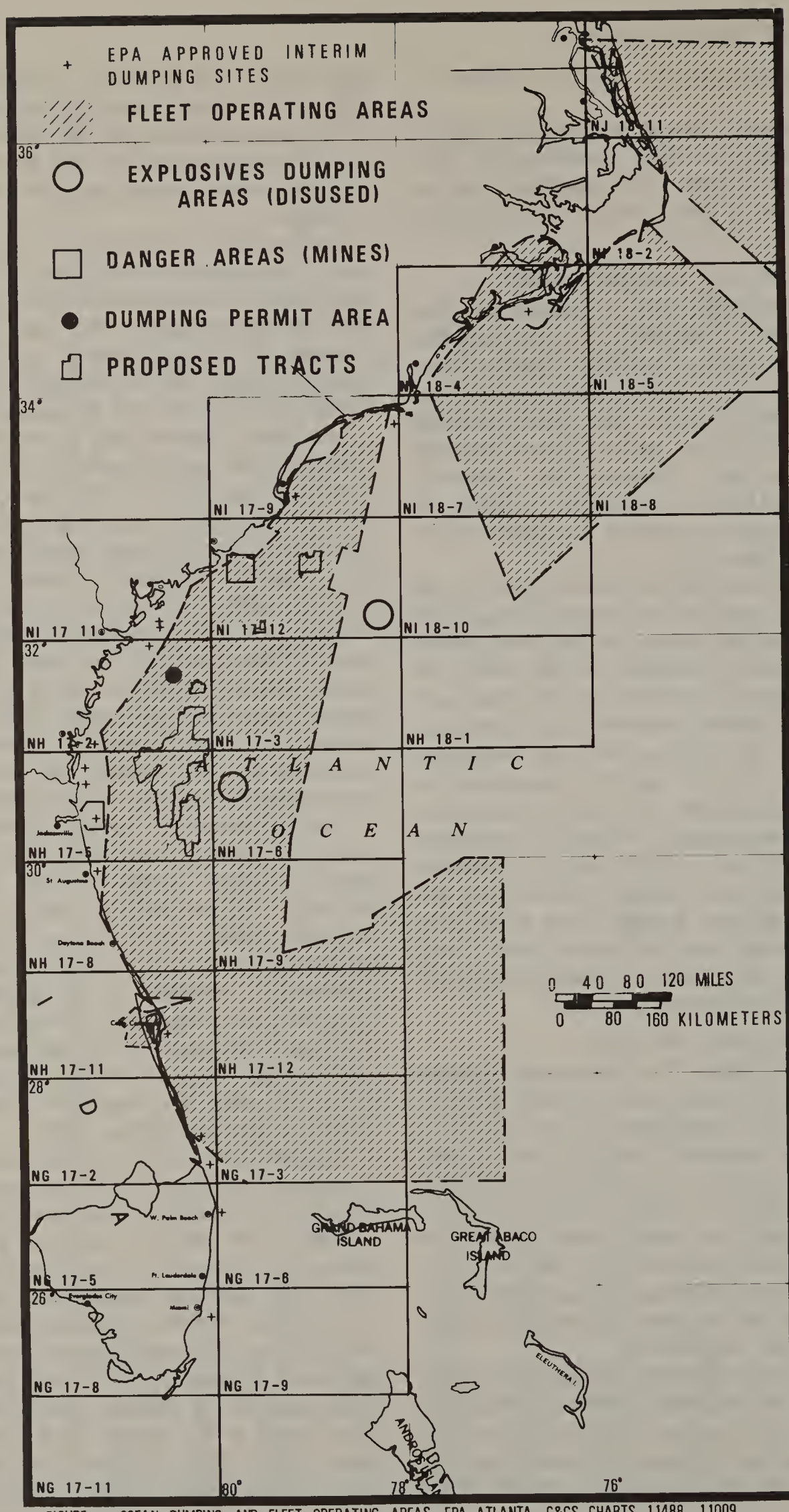


FIGURE G-3 OCEAN DUMPING AND FLEET OPERATING AREAS. EPA ATLANTA, C&GS CHARTS 11488, 11009, COMEASTSEAFRON INSTRUCTION 3120, S.C. JUNE 1972.

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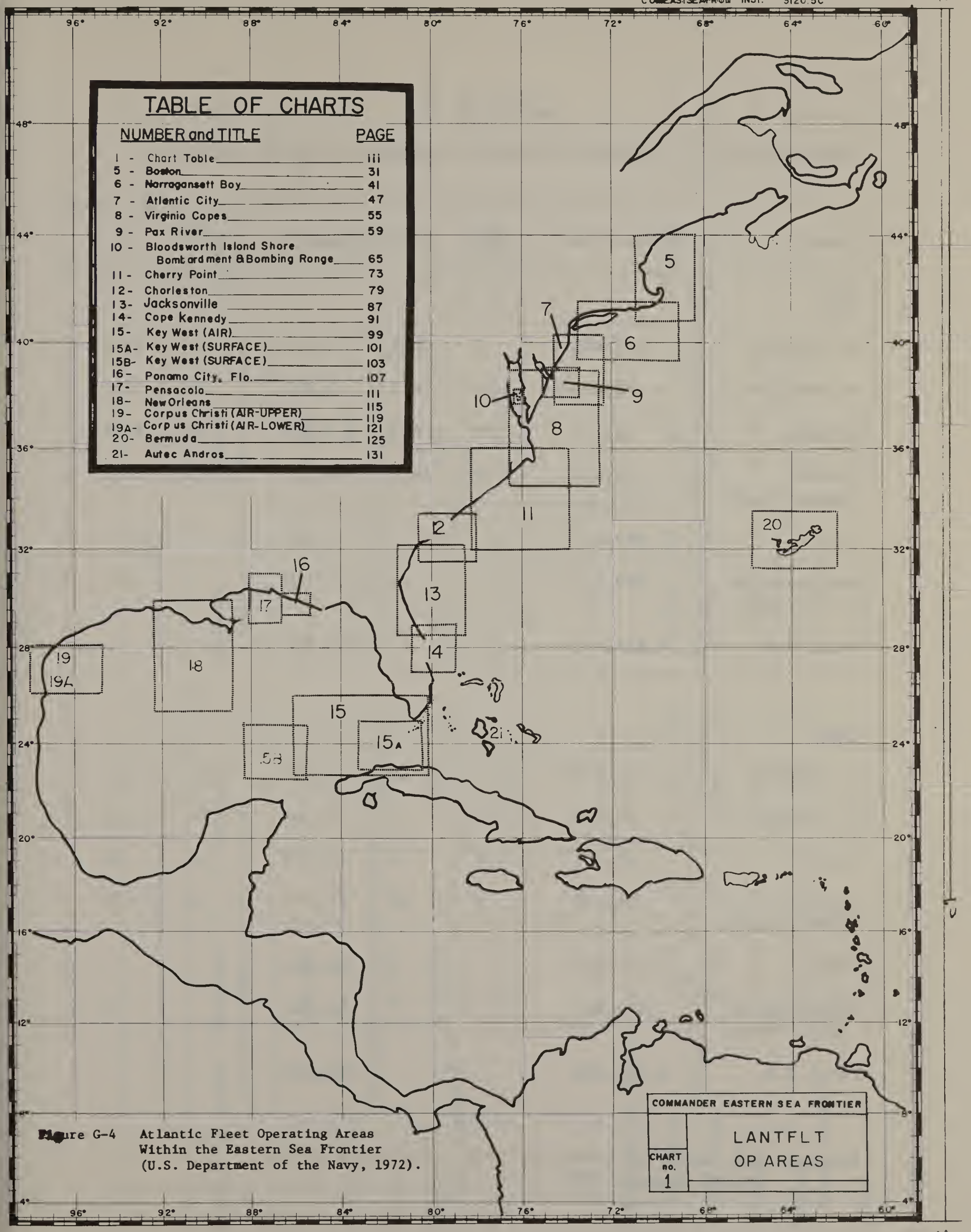


Figure G-4 Atlantic Fleet Operating Areas Within the Eastern Sea Frontier (U.S. Department of the Navy, 1972).

Table G-14

Southeastern U.S. Commercial Fisheries Landings by State, 1974-1975

State	Thousand lbs.	Rank	%	Thousand $	Rank	%
1974						
N. Carolina	206,683	7	68.9	17,544	13	36.8
S. Carolina	18,402	19	6.1	6,861	19	14.4
Georgia	18,157	20	6.1	7,094	18	14.9
Florida (east coast)	56,695	8	18.9	16,211	5	33.9
Total	299,937			47,710		
Southeastern U.S. Total	299,937		6.1	47,710		5.3
Total U.S.	4,939,600			898,500		
1975						
N. Carolina	238,296	7	73	20,003	14	33
S. Carolina	20,078	19	6	13,116	17	22
Georgia	17,751	20	5	11,943	18	20
Florida (east coast)	51,276	8	16	15,603	6	25
Total	327,401			60,664		
Southeastern U.S. Total	327,401		7	60,664		6
Total U.S.	4,841,800			970,800		

Source: U.S. Dept. of Commerce, 1976. Fisheries of the United States, 1975.

Table G-15

Southeastern U.S. Commercial Finfish and Shellfish Landings by State, 1972 - 1974

	1972				1973				1974			
Finfish by State	Thousand lbs.	%	Thousand $	%	Thousand lbs.	%	Thousand $	%	Thousand lbs.	%	Thousand $	%
N. Carolina	146,847	75	5,761	50	111,867	69	8,516	55	173,240	82	10,347	60
S. Carolina	5,216	3	718	6	3,886	2	663	4	2,770	1	490	3
Georgia	1,075	1	279	2	7,984	5	241	2	728	1	246	2
Florida (east coast)	42,583	21	4,800	42	38,875	24	6,021	39	33,898	16	6,058	35
Total	195,721		11,558		162,612		15,441		210,636		17,141	
Shellfish by State												
N. Carolina	21,055	29	6,038	19	18,586	29	7,439	19	22,809	31	6,978	23
S. Carolina	16,840	23	7,107	23	17,187	26	10,603	27	16,225	22	6,627	22
Georgia	14,469	23	6,527	21	16,344	25	10,382	27	17,426	24	6,849	22
Florida (east coast)	17,487	25	11,288	37	12,974	20	10,215	27	17,052	23	10,180	33
Total	71,904		30,966		65,091		38,639		73,512		30,634	

Source: U. S. Department of Commerce, 1976.

Table G-16

Major Species of Finfish Caught, Southeastern U.S., 1974

Species	Total Pounds Thousands	Weight Ranking	Total Prices Thousands
Menhaden	133,836,125	1	3,287,481
Flounder	12,143,813	2	2,927,916
Spot	7,729,450	3	926,094
Alewives	6,331,009	4	253,923
Mullet	6,327,045	5	616,124
Sea Trout, Grey	6,187,070	6	657,322
Croaker	6,185,558	7	618,269
Herring, Thread	4,448,184	8	121,975
King Mackerel	4,317,946	9	1,706,029
Bluefish	3,455,693	10	401,109
Catfish (sea)	2,898,692	11	527,802
Spanish Mackerel	2,422,148	12	468,870
Sea Bass	1,580,935	13	616,391
King Whiting	1,476,693	14	263,782
Sea Trout, Spotted	1,353,146	15	482,692
Striped Bass	1,016,191	16	393,187

Source: U.S. Department of Commerce, 1976.

Table G-17

Price/Pound Ranking of Finfish, Southeastern U.S.

Species	Price Per Lb.	Ranking
Pompano	$ 1.14	1
Red Snapper	.72	2
Snapper (unclassified)	.71	3
Hogfish	.45	4
Groupers	.42	5
King Mackerel	.40	6
Sea Bass	.39	7
Striped Bass	.39	8
Tilefish	.36	9

Source: U.S. Department of Commerce , 1976.

Table G-19

Seafood Processing and Wholesale Establishments and Employment, Southeastern U.S., 1973

Area and State	Processing			Wholesale			Total		
		Employment Average			Employment Average			Employment Average	
	Plants	Season	Year	Plants	Season	Year	Plants	Season	Year
Southeastern U.S.:									
North Carolina . . .	81	2,095	1,371	103	403	287	184	2,498	1,650
South Carolina . . .	22	787	619	62	367	213	84	1,154	832
Georgia	14	2,056	1,595	41	295	202	55	2,351	1,797
Florida, East Coast.	42	1,396	1,197	68	191	179	110	1,587	1,376
Total	159	6,334	4,782	274	1,256	881	433	7,590	5,663

Source: U.S. Department of Commerce, 1976.

Table G-20

Number of Full-Time and Part-Time
Commercial Fishermen,
Southeastern U.S., 1974

State	Full-Time	Part-Time	Total
N. Carolina	2,455	1,850	4,305
S. Carolina	760	860	1,620
Georgia	759	835	1,594
Florida	9,700	1,950	11,650

Source: U.S. Department of Commerce, 1976.

was approximately a nine percent increase in the total catch and a 15% decrease in value.

Shrimp constitute the most valuable commercial fishery resources for this area. In 1975, approximately 25 million pounds or 7% and $30 million or 13% of the United States shrimp catch was landed in the southeast Atlantic states. This area ranked second in value and third in volume of the total United States catch.

There are five species of shrimp that are caught commercially: brown shrimp (*Penaeus aztecus*); white shrimp (*P. setiferus*); pink shrimp (*P. duorarum*); rock shrimp (*Sicyonia brevirostris*) and royal red shrimp (*Hymenopenaeus robustus*). The shrimp fishery is based primarily upon exploitation of brown and white shrimp which comprise about 95% of the catch. In the past six years the catch of species have varied from year to year (Table G-21-22). It is noted that the royal red shrimp catch has been on a constant decline from 1970 to 1975, in 1976 there was an increase in landings. The pink shrimp catch has increased in landings, while the brown and white catch has fluctuated from year to year.

Shrimp are caught primarily between May and December in coastal waters. The major shrimp fishing areas along the coast are: North Carolina—Pamlico Sound (50% of annual catch), Core, Bogue, White Oak, New, Cape Fear sounds and the mouths of the Neuse and Newport rivers. South Carolina—St. Helena, Port Royal, Calibougue and Bulls Bay sounds. Georgia—Wassaw, Ossabow, Sapelo, St. Simons, St. Andrew and Cumberland sounds. Florida—Fernandina and the mouth of the St. John's River, St. Augustine, New Smyrna and Cape Canaveral sounds. There areas are most productive from the 15 m contour (50 ft.) or about 9.7-11.3 km (6-7 miles) from the shoreline (see Visual Nos. 5N and 5S). There is less extensive trawling south of Fort Pierce due to coral bottoms. Recreational shrimping occurs between May-December and is concentrated in bays and sounds. About 10-15% of the total shrimp catch in the region may be taken by recreational fishermen (Eldridge and Goldstein, 1975).

Royal red shrimp are a deep water species and are found off Florida between Cape Canaveral and St. Augustine. Their commercial importance has been very limited due to the depths (366-502 m) at which they are trawled (Bullis and Rathjen, 1959).

Blue crabs (*Callinectes sapidus*) are the basis for one of the most stable commercial fisheries of the southeast Atlantic. Crab trawling is conducted primarily in sheltered bays and sounds along the coast of Georgia in areas not exceeding 15 m (50 ft.) (Cummins and Rivers, 1962).

There have been massive mortalities and a decline in abundance of the blue crab along the South Atlantic coast from 1960 through 1968. First mortalities occurred in June 1966 from Holden Beach, North Carolina to Ossabow Sound, Georgia and continued sporadically throughout the summer. Further mortalities occurred in June 1967, beginning in Georgia and spreading up the coast as far as the Santee River in South Carolina during the summer. Mortalities beginning in April of 1968 were confined to the Georgia coast. These declines affected the economic stability of the crab industry and commercial fishermen witnessed a drop in production from 40.2 million pounds in 1964 to 24.4 million pounds in 1968 (Manhood et al., 1970). Since then, blue crab landings have increased and in 1974 the total catch for the South Atlantic was 38 million pounds. North Carolina leads in amount of catch—13 million pounds at $1.4 million; Georgia ranked second—10 million pounds at $1.2 million; South Carolina and Florida ranked third and fourth respectively bringing 16 million pounds valued at $2 million. In 1974, the total blue crabs caught in the United States was 143 million pounds at $18 million and for the U.S. South Atlantic region, 38 million pounds at $4.5 million. This indicated that the U.S. South Atlantic States produce approximately 27% of the blue crabs caught in the United States. The individual crab fishermen in 1974 received an average ex-vessel price of $0.16/lb.

The calico scallop (*Argopecten gibbus*) is found off the coast of North Carolina and Florida on continental and insular shelves. Off North Carolina, south of Cape Hatteras, they are found from depths of approximately 13 m (43 ft.) to at least 94 m (310 ft.) (Cummins and Rivers, 1962). Off the Florida east coast, their depth has been reported to be from 9-74 m (29-243 ft.) by Drummond (1969). The calico scallop inhabits open marine water and usually does not occur in estuarine areas (Bullis and Thompson, 1955).

Currents are considered of primary importance in controlling the distribution of scallop larvae and the location of the scallop beds. The beds are

Table G-21

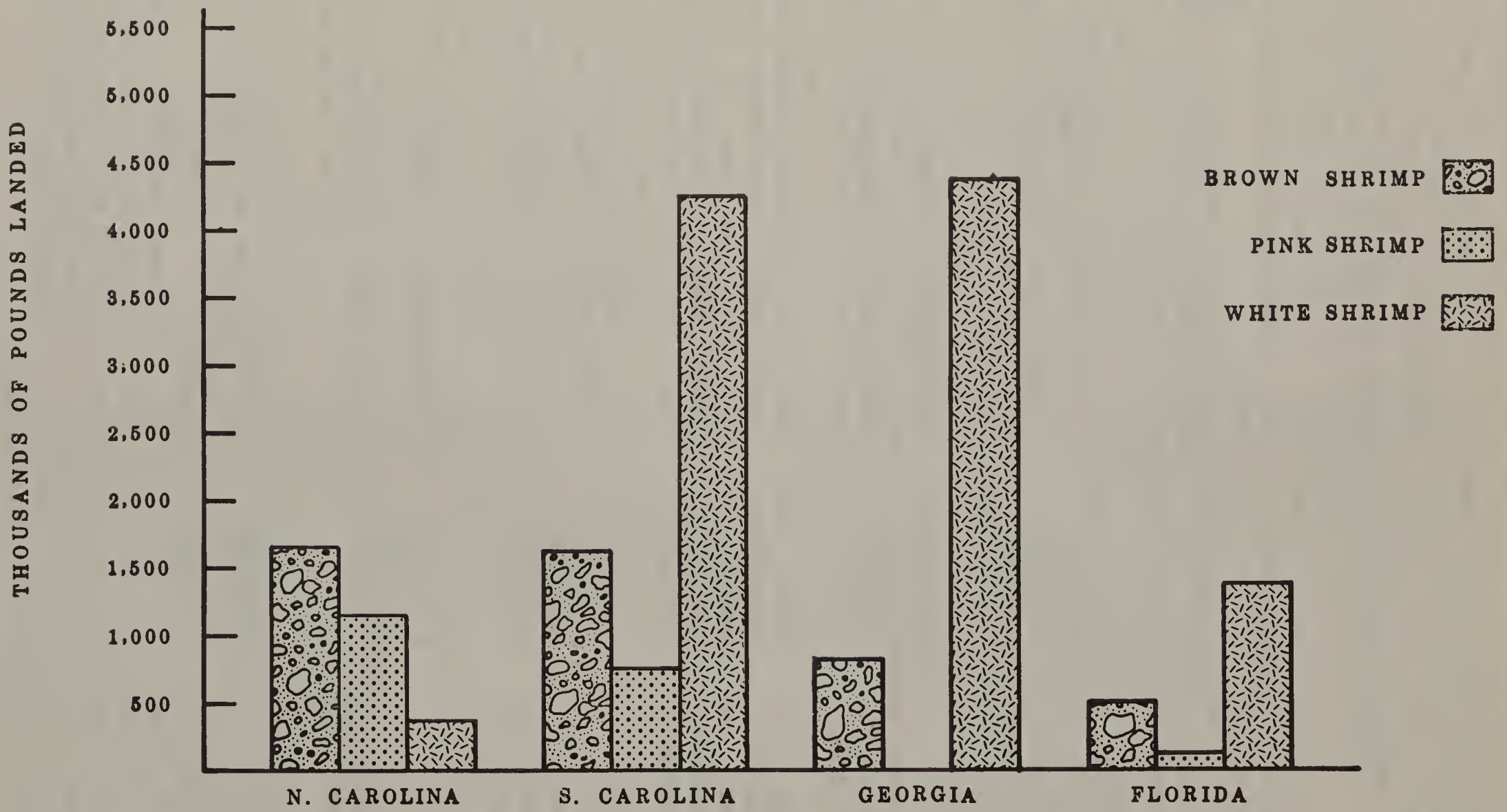
Shrimp Catch for the Southeast Atlantic Region, 1970-1975
(pounds)

	North Carolina	South Carolina	Georgia	Florida (East Coast)
1970				
brown	2,379,976 lbs.	1,160,420 lbs	633,802 lbs	256,314 lbs
pink	534,235	-	775	2,855
white	238,844	2,001,730	3,230,176	2,640,380
royal red	-	-	-	68,323
1971				
brown	3,175,038	1,710,094	716,047	463,702
pink	1,196,660	-	-	-
white	381,994	5,194,397	5,006,227	1,631,865
royal red	-	-	-	87,285
1972				
brown	1,989,967	1,395,522	1,058,507	354,403
pink	492,673	-	-	-
white	1,020,220	3,790,630	3,606,302	2,373,359
royal red	-	-	-	15,408
1973				
brown	1,053,826	1,067,868	377,737	297,401
pink	947,410	-	-	4,423
white	1,166,497	4,244,717	4,960,773	1,473,138
royal red	-	-	-	5,906
1974				
brown	3,809,000	1,291,000	897,000	909,000
pink	1,320,000	-	-	4,000
white	127,000	3,475,000	3,774,000	1,309,000
royal red	-		-	575
1975				
brown	1,601,266	1,478,843	804,964	284,709
pink	1,223,385	7,161	5,520	29,375
white	407,900	4,203,717	4,380,028	1,340,167
royal red	-	-	20,225	6,182

Source: U.S. Department of Commerce, 1976.

TABLE G-22

SHRIMP LANDINGS FOR THE SOUTHEAST REGION, 1975



SOURCE: U.S. DEPARTMENT OF COMMERCE. 1976.

generally located along the flow lines of currents running parallel to the coastline and are associated with beds of turtle grass. Off Cape Canaveral they are distributed irregularly in long narrow bands. The greatest concentration occurs offshore from Cape Canaveral, Florida and Cape Lookout, N.C. (Allen and Costello, 1972).

The commercial production of calico scallops remains low (Table G-23). As indicated, there has not been any catch off the North Carolina coast during the past year. However, this industry looks promising as a result of discovery of large concentrated beds off the Florida east coast and the improvement or processing machines used for harvesting.

Oysters (*Crassostrea virginica*) are found around the mouths of rivers where they enter the sea (Ingle and Smith, 1956). In Georgia, there are approximately 4120 ha (10,180 ac.) of oyster beds that are located intertidally and landward of the barrier islands. The soft mud bottom of the South Atlantic is only marginally suitable for oysters. The beds are better developed in the northern portion of the state where they occur in bands 11-13 km (7-8 mi.) wide. However, all of these beds are located on privately held areas (Johnson, et al., 1974).

Oyster production in the southeast Atlantic states has sharply decreased since 1960. South Carolina leads in oyster production for this area but has had a 33% decrease in the amount of oysters caught. In 1960, a total of 4.1 million lbs. of oysters were landed at a value of $1.6 million for the southeast Atlantic states. In 1974, a drastic decrease to 1.8 million lbs. valued at $1.2 million occurred.

Spiny lobsters (*Panulirus argus*) are caught off the southern tip of the Florida coast. It is an important fishery industry in Dade County, Florida and ranks as the fifth most valuable commercial fishery in the State (Robinson and Dimitriou, 1963). This industry has increased since 1971. In 1974 approximately 3.9 million pounds at $4.8 million were landed in Dade County.

The spiny lobster fishery for the southeastern United States is primarily limited to areas south of Fort Pierce, Florida where there is undulating seafloor topography and/or coral reefs (Little, 1975).

6. Recreation and Allied Resources

The South Atlantic coastal region is noted for its many and varied outdoor recreation resources. Visuals No. 1N and S attempt to geographically identify the major state and nationally recognized public interest areas. Included are publically owned areas like parks, beaches and wildlife lands as well as nationally designated sites and cultural resources, such as natural landmarks and historic register properties. Many nationally designated sites are in private ownership and are not always accessible to the public. The beach areas noted on the visuals were derived from the Corps of Engineers National Shoreline Study and therefore include private as well as public beach areas. A general discussion of the different categories of areas which can provide recreation opportunities are included in the following descriptions.

a. OUTDOOR RECREATION AREAS

Included in this subsection is a discussion of the traditional resources which attract the general public as recreation destination areas. The areas generally described below are specifically identified on Visuals No. 1N and S which also depicts a geographic relationship between proposed sale tracts and individual recreation resource areas.

(1) National Parks:

From the North Carolina-Virginia border to the Florida Keys the National Park Service administers 16 areas under the National Park System. Areas in the National Park System were set aside by the National Congress specifically to preserve recreational, natural and cultural resources of national significance and to systematically devise management schemes which will maximize public appreciation without endangering the resources. Included are four National Seashores, one National Park (Everglades), six National Monuments, two National Historic Sites, two National Memorials and one National Military Park.

In 1975 the most heavily visited National Park areas along the South Atlantic coast were Cape Hatteras National Seashore which received over 1.5 million visitors and Everglades National Park which 866,000 people chose to visit. Included within the 16 areas along the South Atlantic seaboard are three recently authorized areas which are currently undergoing acquisition and

Table G-23

Calico Scallop Landings for the
Southeast Atlantic Region 1962 - 1974
(Thousands of lbs.)

Year	N. Carolina	Fla. East Coast
1962	-	-
1963	-	-
1964	-	-
1965	871	-
1966	1,857	-
1967	1,389	21
1968	-	30
1969	-	181
1970	1,574	196
1971	-	-
1972	1,050	302
1973	556	2
1974	-	-

Source: U.S. Department of Commerce, 1976.

development phases. Included in this category are Canaveral and Cumberland Island National Seashores and Biscayne National Monument. All three areas should attract a large percentage of the recreating public seeking water oriented and water enhanced recreation activities in the years to come.

(2) *National Forests:*

Within the coastal region of the South Atlantic there are the three National Forests encompassing a total of 759,244 acres (307,256 hectares). The Croatan National Forest in North Carolina and the Francis Marion National Forest in South Carolina are located within a few minutes drive from the Atlantic coast whereas the Ocala National Forest is approximately an hour's drive inland from the east coast of Florida.

All national forests present a forest based recreation environment managed by the U.S. Forest Service under the multiple use principle for wood, water, forage, wildlife and recreation. The three national forests found in the South Atlantic coastal region have specifically designated recreation sites accommodating the recreation needs of campers and picnickers, however the greatest public use stems from dispersed recreation use throughout the forest environment. Opportunities for hunting, freshwater fishing, hiking and sightseeing attract most visitors to national forest in the coastal zone.

(3) *National Wildlife Refuges:*

Twenty national wildlife refuges are located along the South Atlantic coast. Most tend to be oriented towards the protection of waterfowl and other wetland wildlife, however all encourage public visitation and accommodate those recreational activities that are compatible with the primary wildlife mission of the refuges.

Most refuges like Pungo National Wildlife Refuge in North Carolina which is primarily a Canada Goose wintering area encourage activities such as nature study, photography and wildlife observation. Other refuges like Merritt Island, Blackbeard Island and Cape Romain have areas specifically designated for public hunting and fishing.

(4) *State Parks:*

Over 30 state parks dot the coastal area. These are rather well distributed along the coast with a slight concentration in Florida. These recreational areas vary in size and function from multi-activity recreation areas to sites managed specifically for historical interpretation. Similar to the National Park System some states have established classification systems for their state parks which distinguish between recreation areas, historical areas, preservation or natural areas, demonstration areas, etc.

Examples of state parks would include Hammocks Beach State Park, an 890 acre (360 hectare) facility on the seashore of North Carolina. The park offers facilities for picnicking, camping, boating, swimming and fishing. In contrast to this is Old Dorchester State Park in South Carolina. This is the site of a Revolutionary War fort. It is only 8.9 hectares (22 acres) in size and offers few activities other than visiting the fort. John Penneycamp State Park on the southeastern coast of Florida is a unique type state park focusing visitor use and appreciation of submarine resources such as coral reefs and shipwrecks. Another underwater park on black rock reefs off Topsail Beach, North Carolina is currently under consideration. Here again, delicate reefal flora and fauna will be the focus of submarine users attracted to this natural resource.

(5) *State Forests:*

State forests are managed primarily for timber resources but like national forests they provide an environment suitable for forest recreation activities. Cary State Forest in northern Florida is the only state forest located in a coastal county along the South Atlantic seaboard. State forests generally are considerably smaller than national forests found within the South Atlantic region but provide similar type recreational activities compatible with a forest environment.

(6) *State Wildlife Refuges and Management Areas:*

Although management goals may differ somewhat from state to state, these areas serve primarily to maintain habitat and breeding space for wildlife, and to provide wildlife-oriented recreation under closely controlled conditions.

There are 25 such areas along the coast extending from Northwest River Marsh State Game Land in northeastern North Carolina to Everglades State Wildlife Management Area north of Everglades National Park.

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(7) *Local Outdoor Recreation Areas and Facilities:*

In addition to Federal and State recreation areas, there are numerous city and county parks and recreation areas in the coastal zone. These facilities are generally found in and around the major population centers where the demand is greatest. In addition, private and commercial recreational facilities exist in great numbers along the South Atlantic coast. The list could include resorts, marinas, tennis clubs, amusement and theme parks, water access sites and many others. Due to their large number, small size, and difficulty in obtaining comparable data for the entire area a complete mapping or listing of these facilities and areas was not attempted.

(8) *Specifically Designated Areas:*

This subsection was included to describe those classification systems which designate certain natural resources of state and national significance. Such areas are usually so identified in order to proclaim the value of their innate natural qualities and to foster the preservation of these same qualities for educational, aesthetic and scientific purposes. These same areas either by design or happenstance accommodate a selected range of recreation activities.

The National Natural Landmark Program administered through the National Park Service has as its primary objective to encourage the preservation of sites illustrating the geological and ecological character of the United States. Publicly or privately owned, a Registered Natural Landmark is a selected portion of America's land and waters.

Because of the rapidly growing nature of the natural landmarks program, both actual sites and sites being considered for inclusion into the register by the National Park Service are included on Visuals 1N and S. There are 56 such sites identified along the South Atlantic coastal area, many of which are included as part of outdoor recreation areas such as state parks or national wildlife refuges.

The State of Florida as well as the Federal Government have established marine preserve systems.

Florida owns about 25,806 sq. km (10,000 sq. miles) of submerged tidal lands. Much of this submerged land supports biological, aesthetic and other natural features important ecologically and for outdoor recreation. To set aside certain exceptionally valuable and representative areas for perpetual public enjoyment and to preserve important natural systems, a statewide system of aquatic preserves was established in 1969. Eleven aquatic preserves are distributed along the coast, most being located in lagoons behind the barrier islands which extend along much of the eastern coast of the state.

Title III of the Marine Protection Research and Sanctuaries Act of 1972 gave the Secretary of Commerce (NOAA) the authority to designate national marine or estuarine sanctuaries in coastal marine waters. Within the geographic jurisdiction of this statement the John Penneycamp Marine Sanctuary off the southeast coast of Florida and the Monitor Marine Sanctuary seaward of North Carolina's Cape Hatteras National Seashore and the Duplin River Estuary on the Southern end of Sapelo Island have thus far been designated.

There are no nationally designated wild and scenic rivers in the coastal area of the four states influenced by this proposed sale. The Ogeechee River in Georgia is the only waterway thus far identified as a potential study river for national classification. All states however have enacted enabling legislation and are progressing towards selection of specific rivers for recognition, protection and management in state administered systems.

The Department of Natural Resources in the State of Florida has developed a canoe trail system. Rivers identified with stretches denoted as pleasant for canoeing along the east coast include: St. Mary's, Econlockhatches, and Loxahatchee Rivers and Bulow and Spruce Creeks.

(9) *Recreation Beaches and Barrier Islands:*

Wherever they are accessible for recreational use the sandy beaches and barrier islands along the South Atlantic coast are of major recreational importance. From Cape Hatteras, North Carolina to Key West, Florida, an ocean shoreline distances of 1917 km (1,192 miles), a wide variety of recreational opportunities, numerous unique environmental areas, and panoramas of scenic beauty can be found. Included in this extensive expanse of shoreline is 1575 km (979 miles) of ocean beach in addition to 12,956 km (8,052 miles) of bay/estuary shoreline. As a matter of law most states recognize that portion of beach property between the mean high and mean low water lines

as public trust land dedicated to citizen use and enjoyment. Furthermore, some states, Florida for example, have shown through litigation that the privately held dry sand beaches above the mean high water line are subject to the interest and rights of the public to customary recreational uses (Fla. 1974).

The predominance of barrier islands is another characteristic of the South Atlantic coast. Examination of coastal charts as well as Visuals 1N and S will show that barrier islands align almost the entire South Atlantic seaboard. These islands vary considerably in size, shape, length, width, height, vegetational characteristics and development. They are generally backed by shallow, narrow lagoons, bays or sounds usually with extensive marsh systems.

The 1575 km of sandy beach along the South Atlantic coast are generally composed of quartz type sand with shell content varying widely. The beach at Hunting Island, South Carolina for example, is composed of very fine gray sand almost devoid of any shell fragments, whereas near Flagler Beach, Florida, the content of reddish shell fragments in sand is high enough to give a rusty appearance to the beach. Whatever the type, all the natural beaches along the South Atlantic states unspoiled by incompatible human activities are very attractive recreational resources.

Table G-24, a summary of South Atlantic shoreline resources, as well as much of the resource data in this subsection comes from the Corps of Engineers National Shoreline Study Report (1973). As is indicated in the table a large percentage of the beaches and islands along the South Atlantic coastline are in public ownership. Many of the national and state parks and wildlife areas noted earlier in this section comprise a large percentage of this shoreline resource. Recent national and state acquisition programs are dedicating additional shoreline acreages to park and wildlife programs. The beaches of Cape Canaveral and the uplands of Cumberland Island are two examples where the National Park Service is currently devising use schemes which will encourage public appreciation of the inherent natural values of these lands. Suitable portions of the Federal recreation estate are also being considered and included in the national wilderness system.

Much of the privately controlled beach frontage and coastal islands also serve as recreation attractions in the form of resorts, country clubs, marinas, private residences, and tourist accommodations. Examples would include South Carolina's 80.4 km (50 mile) seashore vacation land and residential area known as the Grand Strand and the Sea Pines Resort on Hilton Head Island.

In summary, shoreline recreation resources such as beaches and barrier islands serve as a first line of defense or natural buffer between ocean waters and inland areas. Likewise this buffer area and transition zone is also potentially vulnerable to offshore oil spills and to direct visual impact from any nearshore structures or lease generated traffic.

B. COASTAL RECREATION ACTIVITIES

The diverse environments found in areas where water and land converge presents an interesting setting for leisure pursuits. In the more than 1900 km (1,200 miles) of ocean shoreline from North Carolina to Southern Florida one finds barrier islands, coastal beaches, estuarine bays and sounds, the tidal marshes contributing to an atmosphere supportive of water dependent and water enhanced outdoor recreation activities.

Traditionally, the shoreline of the Atlantic Ocean has provided residents of Coastal States and tourists with an opportunity to enjoy and participate in a wide range of activities. A precise assessment of the scope of this public use is difficult. No comparable use figures regarding user activities in the immediate coastal area are available for the four states adjacent to this proposed lease sale. All states, however, show swimming, fishing, picknicking and boating as some of the most popular forms of outdoor recreation statewide. Likewise, State Comprehensive Outdoor Recreation Plans (N.C., S.C., Ga., and Fla. SCORPS, 1971, 1972, 1975 and 1976) for the four South Atlantic Coastal States show beach activities, fishing, nature appreciation, camping and hunting as forms of outdoor recreation sought by residents and out-of-state visitors. Hunting, fishing, nature appreciation, camping and beach appreciation are forms of recreation especially popular along the undeveloped islands inaccessible to automobiles along the coasts of North Carolina, South Carolina and Georgia.

Other coastal recreation activities occurring on the immediate shoreline potentially affected by this proposed sale are resource dependent with very little published materials on the nature and

Table G-24. SOUTH ATLANTIC - Selected Shoreline Information
(kilometers)

	OCEAN	OWNERSHIP			
State	Shoreline	Federal	Non. Fed. Public	Private	Uncertain
No. Carolina	515	225	21	269	0
So. Carolina	300	40	24	224	13
Georgia	148	26	18	105	0
Florida (West Coast	954	76	92	719	67
Total	1,917	367	155	1,318	80

	BAY/ESTUARY	OWNERSHIP			
State	Shoreline	Federal	Non. Fed. Public	Private	Uncertain
No. Carolina	5,367	890	74	1,408	3,204
So. Carolina	4,627	660	2,312	1,115	541
Georgia	180	21	18	142	0
Florida (West Coast)	2,772	180	48	2,544	0
Total	12,955	1,551	2,452	5,209	3.744

Source: Extracted from Corps of Engineers National Shoreline Study, 1973.

scope of public use. Examples would include clamming, crabbing, oyster gathering, cast netting, etc.

The area most directly affectable by the proposed oil and gas lease sale would be the offshore marine environment or the Atlantic Coastal waters (neritic zone). These waters serve as a basic resource for the two major outdoor recreation activities common to the four states-recreational boating and fishing.

c. Recreational boating

The third most popular recreational activity within this entire region is boating. Ridgeley (1975) estimated that the South Atlantic Region (excluding Florida, which was included in the Gulf Region) had 751,000 recreational boats of all sizes and that approximately 157,000 of those fished in salt water at some time. With the inclusion of the eastern coast of Florida in the region, this part of the nation would rank high in its use of coastal waters for recreational boating activities of all kinds.

North Carolina's coast with its outlying banks is particularly well suited to recreational boating. Recreational development on the mainland along the coast reflects this in the construction of 80 marinas, 50 fishing piers and 75 boat ramps.

Approximately 14% of all North Carolina households own a boat. Considering all households in the state together, about 2.5 days per year per household are spent in some kind of boating activity (North Carolina Department of Natural and Economic Resources 1972).

In 1968, figures indicated that 10 million participation days were spent fishing and 3.4 million for boating. Boating has shown an increase in the state of nearly five times the population growth. To support the fishing and boating activity, there were 106,000 outboard motors of 10 horsepower or more, and 10,000 inboard motors. Deep sea fishing is supported by 154 charter boats, 14 "head or party boats" and a large portion of the inboard motor boats registered in the state (Planners, Inc. 1974).

In South Carolina, the Department of Parks, Recreation and Tourism has collected data for the entire state by subregions, a system which allows a study of only the coastal subregion. The study reveals 70 boat ramps along the coast with berthing for 1,228 boats in marinas. In addition, rental boats of various sizes provide seating for a total of 897 persons (Planners, Inc. 1974). A total of 28,319 power boats were registered in coastal counties during 1973 (South Carolina Division of Research and Statistical Services, 1974).

A study by the State of Georgia (1975) indicated that there were about 70 points along the coast where boats have access to water. This includes some 20 boat ramps, 26 fish camps and 17 marinas. The study also indicated that the lack of public access to many coastal islands hampers their potential use as recreational boat launching points. Throughout the state, boating is the eighth most popular recreational activity with 5.05% of the adult population participating (State of Georgia, 1972).

Florida's climate and her status as a recreational mecca for out of staters helps boost the importance of boating in the state. Figures from "Outdoor Recreation in Florida", are given based on state planning regions. In order to concentrate mostly on the coastal areas, figures for salt water are used here; however, it must be recognized that fresh water boating activities extend from the inland into the coastal areas. In 1971, the Florida coast north of Palm Beach provided 114 salt water oriented boat ramps, 43 marinas and 21 boat lifts. These structures can economically provide for the peak demand needs of 54,315 persons per day (State of Florida, 1971).

Finally, the Intracoastal Waterway plays a part in recreational boating in all of the states by providing a safe, well marked channel for coast-wide navigation for short distance travel, but also for the very long distance movement of pleasure craft.

d. Sport fishing

A salt water angling survey conducted by the National Marine Fisheries Service (NMFS) in 1970 provides the most recent comprehensive sport fishing statistics for the South Atlantic (Deuel, 1973, Table G-25). However, Deuel (1975) has in progress a survey on recreational fishing in the South Atlantic for calendar year 1975 which will be published by the Division of Statistics and Market News—NMFS at a later date.

Geographic boundaries for the South Atlantic angling survey of 1970 are from Cape Hatteras, N.C. to southern Florida including the Florida Keys.

It was estimated that 1,808,000 salt water anglers were active in the South Atlantic in 1970.

Table G-25 Estimated number of salt-water anglers and their catches in the United States in 1960, 1965, and 1970, by survey region.

Region	Number of anglers			Number of fish caught			Weight of fish caught		
	1960	1965	1970	1960	1965	1970	1960	1965	1970
	Thousands						Thousand pounds		
I. North Atlantic (New England and New York)	1,160	1,530	1,666	97,383	172,660	117,014	183,740	316,360	267,451
II. Middle Atlantic (New Jersey to Cape Hatteras)	1,344	1,375	1,767	114,502	92,126	168,209	178,000	128,288	246,267
III. South Atlantic (Cape Hatteras to Florida Keys)	1,024	1,720	1,808	156,942	190,802	184,177	370,112	391,833	403,913
Gulf of Mexico 1/ (Florida West Coast to Texas)	1,412	--	--	184,582	--	--	411,110	--	--
IV. East Gulf of Mexico (Florida West Coast to Mississippi River)	--	1,234	1,478	--	104,551	188,888	--	187,957	334,120
V. West Gulf of Mexico (Mississippi River to Texas)	--	738	872	--	89,550	97,708	--	187,618	151,608
VI. South Pacific (Pt. Conception South)	687	978	894	50,064	48,542	37,221	154,120	176,828	94,234
VII. North Pacific (Pt. Conception North)	714	999	1,311	23,399	38,508	24,100	83,219	85,469	79,230
	6,198 2/	8,236 2/	9,392 2/	632,872	736,739	817,317	1,380,301	1,474,353	1,576,823

1/ The Gulf of Mexico was not separated into East and West sampling regions for the 1960 Angling Survey.
2/ These figures are less than the sum of anglers for the individual regions because some anglers fished in more than one region.

Source: (Deuel, 1973)

The estimated number of fish landed was 184,177,000 with a weight of 403,913,000 pounds. The principal method of fishing was by private or rented boat with bridge, pier or jetty ranking second, party or charter boat third, and beach or bank fishing ranking fourth. The principal area of fishing was the ocean, with sounds, rivers and bays second. Table G-26 gives a breakdown of these statistics.

The offshore charter boats fish from 8-121 km (5-75 mi) off the coast for big gamefish. These boats specialize in offshore trolling for fish ranging from Spanish and King mackerel to sailfish and blue marlin. These boats operate under a fixed fee depending on the species of fish sought. Usually four to six fishermen are accommodated on these trips.

Inshore charter boats generally carry three to six anglers for a fixed fee per trip. These boats fish the rivers and sounds specializing in sea trout, channel bass, flounder and cobia.

Offshore head boats fish bottom areas which lie 8-80 km (5-50 mi) off the coast, depending on whether black sea bass or larger snapper and grouper are being sought. A wide variety of trips are offered by these boats depending on what type of fishing the angler desires and how much time he has to spend. Fees are charged per angler, usually with discounts to large groups.

Freeman and Walford (in press) will present a geographical study of marine recreational fishing for the South Atlantic in a series of publications entitled "Angler's Guide to the United States Atlantic Coast". The purpose of this publication will be two-fold. First, it will serve as an atlas dealing with the location of the fishing grounds, the various boating and fishing facilities, local conditions and characteristics of fishing, as well as the diagnostic features, life habitats and environmental requirements of fishes that are of particular interest to anglers. Secondly, it will serve as an assessment of knowledge about marine fishes which anglers catch, including their life conditions, and the status of those fishes in the 1970's.

Salt water sportfishing as previously stated includes an inshore and offshore fisheries, with approximately 400 species of fish found in these waters. Bearden and McKenzie (1973) listed three major ecological groupings being prominent:

Inshore species: both resident and migratory fishes are found close to shore and in the coastal estuaries including: drum, croaker, spot, flounder, sheepshead, shad, striped bass, sea trout, cobia and channel bass.

Offshore migratory species: seldom found inshore except when young: tunas, mackerels, jacks, bluefish, dolphin and billfish.

Offshore bottom species: found on reefs, rough bottom areas and old wrecks: black sea bass, snappers, porgies, groupers and grunts.

Discussions and locations on reefs, rough bottom areas ("live bottom") and artificial reefs may be found in Section II.E.1.g. and Visual Nos. 4N and 4S.

(1) North Carolina

North Carolina coastal salt water fishermen are faced with the problem that most close to shore ocean bottoms are barren sand and silt surface. Fish are usually rather sparse in these areas. For a good catch, fishermen usually go to capes or shoals to try for the schooling fish. Stone jetties near inlets also attract fish. Other good fishing sites include offshore wrecks, which are usually not too accessible to the fisherman with a smaller boat. Recently, however, another alternative, artificial reefs, has been added. The reefs are located close to shore so therefore, most fishermen that have a boat of moderate size can safely reach them as well as the live bottom areas so popular with coastal fishermen. Like live bottoms, artificial reefs provide habitat for bottom dwelling fish and attract ocean ranging fish.

Robertson (n.d.) gives a complete description of salt water fishing in North Carolina in an atlas entitled "Salt Water Sport Fishing and Boating in North Carolina" which indicates a fishery similar in species and seasons to those for the other South Atlantic States.

(2) South Carolina

The following discussion was taken from Bearden and McKenzie (1973).

The inshore group of fishes is the most important and is sought by pier, surf and small boat anglers. The most frequently caught inshore species in South Carolina waters are as follows: spotted sea trout (winter trout), channel bass (red drum), spot, flounder, king whitings, Spanish mackerel, black sea bass, croaker, bluefish and black drum.

The major types of fishing in the State are shore, pier and bridge, small boat, charter boat and head boat fishing. Small boat fishing in the tidal rivers, sounds and near-shore ocean waters is the most popular form of saltwater angling ac-

Table G-26 Salt-Water Fishermen and Their Catches by Principal Area and Method of Fishing - 1970

Region	Ocean	Principal area of Fishing: Sounds, rivers, and bays	Principal area of Fishing: Private or rented boats	Principal methods of fishing: Party or chartered boats	Principal methods of fishing: Bridge, pier, or jetty	Principal methods of fishing: Beach or bank
		Thousands				
South Atlantic:						
Number of fishermen...	1,127	773	505	450	565	483
Number of fish caught.	112,203	71,974	74,214	19,545	47,555	42,863
Total weight (000 lbs.)	287,385	116,528	224,476	56,417	69,363	53,657

Source: (Deuel, 1973)

tivity. Recently, the offshore fishing grounds on the continental shelf areas were recognized as almost virgin territory with an unlimited potential for big game fishing. The addition of man-made fishing reefs in certain less productive areas of the ocean had led to excellent near-shore bottom fishing and trolling opportunities.

Aside from excellent hook and line fishing, the Palmetto State offers other saltwater recreational fishing activities such as crabbing, shrimping, clam digging and oyster picking in almost any unspoiled area along the coast.

(3) Georgia

While the best salt water fishing is found in Georgia during the fall and winter months, many fishermen are sucessful almost year round (Georgia Department of Natural Resources, n.d.).

Because of the vast stretches of estuaries and sounds, a major portion of Georgia's salt water fishing activity takes place in inshore waters. Coastal anglers fish from piers, bridges, banks and small boats. Common fish caught include seatrout, striped bass, black sea bass, sheepshead, shad and tarpon.

Offshore species found in Georgia waters include Spanish mackerel, bluefish, cobia, red snapper, flounder, crevalle jack, greater amberjack, little tuna, king mackerel, great barracuda, Atlantic bonita and even sailfish. The warm Gulf Stream waters pass by Georgia on the way from Florida to North Carolina, and species that are taken either north or south may be caught in Georgia waters.

In July and August, huge schools of Spanish mackerel and bluefish move with the Gulf Stream northward from the Bahamas. They are caught by trolling 8-10 km (5-6 mi) from shore and at the mouths of the large sounds between the offshore islands.

(4) Florida

Salt water sport fishing is very important in Florida. According to Taylor et al. (1973) the sport fishing "industry" earned $350 million in 1971 and had been growing at an annual rate of $25 million per year. Man-days spent in salt-water sport fishing in 1971 were estimated at 8,800,000. No breakdown in the statistics was made between the Atlantic and Gulf coasts of Florida, but the Florida Department of Natural Resources estimated in 1972 that approximately 50% of the salt water sport fishing in Florida can be attributed to the Atlantic coast.

The Florida Department of Natural Resources, and the Florida Marine Patrol (1975), Tallahassee, Florida give weekly, quarterly and annual salt water sport fish forecasts by areas for the entire coastline.

Common fishing locations included canals, inlets, surf, rivers, pier and jetties, bridges, beaches and offshore. Offshore areas include wrecks, reefs, holes and artificial reefs. Many species were abundant all year while some species were only seasonal.

E. CULTURAL RESOURCES

(1) Procedures used to identify cultural resources

In the OCS area covered by this description cultural resources data offshore is uneven in its coverage and level of detail. The data acquired was limited solely to information on the locations of shipwrecks. The locations for onshore cultural resources were obtained from national and state lists as there has been no cultural resource inventory work carried out by the BLM in the study area.

Information on cultural resources on the sea bottom was obtained from three sources containing the locations of shipwrecks. The most complete as far as area coverage is the Unclassified Non-Submarine Contracts List (1976) produced by the U. S. Navy Oceanographic Office. The list is concerned mostly with post-1900 shipwrecks; however, older shipwrecks are also included but not identified. Another source is An Oceanographic Atlas of the Carolina Continental Margin (Newton et al., 1971) which contained a detailed map and descriptive list of shipwrecks of all ages in the Cape Fear-Cape Hatteras Region. The third source is a map entitled Shipwrecks and Submerged Archaeological Sites in Florida Coastal Waters (Florida Department of State, 1973). Shipwrecks are represented on Visuals Nos. 4N and 4S.

Coastal cultural resource information was obtained from two basic sources. The Federal Register of February 10, 1976, updated to May 4, 1976 provided a list of sites on, or eligible for inclusion, on the National Register of Historic Places. These sites are represented on Visual Nos. 1N and 1S. Further data was obtained in contacts with the State Historic Preservation Offices of the various states. These are in the form of maps or lists of sites of historic or archaeologic nature which are considered important.

(1) North Carolina, 1975. North Carolina Historical Commission list of National Register Sites, National Historic Landmarks and G. S. Chapter 121 properties.
(2) South Carolina, 1975. List by county of National Register Sites, state historic sites, and archaeological sites.
(3) Georgia, 1975. "Resources for Preservation". Maps by County from; Coastal Resources Maps prepared by Resource Planning Section, Department of Natural Resources.
(4) Florida, 1973. Shipwrecks and Submerged Archaeological Sites in Florida Coastal Waters, map by Division of Archives, History and Records Management.

(2) Cultural context

Shipping, and hence shipwrecks, in the waters of the Southeast cover a five hundred year span of time. Probably the greatest early concentration of shipping and shipwrecks is along the Florida coast related to the movement of Spanish treasure fleets (Florida Dept. of State, 1973). While taking advantage of northeasterly winds and the currents of the Gulf Stream, Spanish fleets traveled northward along the Florida coast before striking out across the Atlantic, storms wrecked a large number of these vessels in shallow waters along the southern part of this region.

Later shipping associated with the settlement and economic development of the coastal area by the English concentrated itself further towards the north, especially off the coast of the Carolinas.

Here vessels engaged in coastal trading frequently came to grief along the coast. A particularly heavy toll of vessels was extracted by the rough, shallow waters around Cape Fear and Cape Hatteras (Newton, et al., 1971).

As settlement and economic development progressed during the nineteenth century shipping increased considerably and the waters of the region contained numerous ships plying the coastal trade business, international trading ships, and some fishing vessels. During the age of sail, when ships were more at the mercy of the elements than the powered ships of today, wrecks along the coast were frequent, again with heavy concentrations in the Cape Fear and Cape Hatteras areas and near the ports of Charleston, Georgetown and Port Royal.

The Civil War increased the number of wrecks throughout the offshore area due to naval operations associated with the blockade of Confederate ports, and from losses due to increased traffic. Finally World War I and II added numerous wrecks from natural and combat (mostly submarine) related activities.

The entire ocean area covered by this statement has the potential for holding shipwrecks, however the number of known wrecks decreases very rapidly with distance from shore. The entire coastline and its associated shallow waters has a high potential for containing shipwrecks but the largest concentrations appear to be in the Florida area (Spanish treasure ships) and the Cape Fear-Cape Hatteras, Charleston-Georgetown-Port Royal areas (ships of all ages).

It is difficult to determine the time span during which man has occupied the southeast coast of North America. Evidence varies widely in occupation dates for most parts of the continent, but 12,000 (Before Present) is generally accepted as a date at which many parts of the continent became occupied by Paleo-Indians (Coastal Environments Inc. n.d.). Evidence of such occupation is scattered and difficult to locate but numerous sites have been found in the southwest. During this period of time the last of the continental ice sheets was in the process of melting, and sea level was rising from its estimated lowest level of over 100 m (328 ft.) below present sea level. At the appearance of the Paleo-Indians sea level is estimated to have been approximately 40 m (131 ft.) below present. Thus, Paleo-Indian living sites could be found in areas presently covered by the Atlantic Ocean.

Indian occupation of the coastal area is documented both by archaeological techniques and by the observations of early European explorers and settlers. The Indian population of the area at the time of early European settlement was unknown but estimated to be over 50,000, most of whom lived within one day's travel from the coast. Villages varied in size from 50 to 200 inhabitants, were surrounded by considerable agricultural clearings, and were apparently frequently moved (Brown, 1948). The Indians hunted, fished, gathered wild foods and practiced farming. Evidence of their occupation of the areas can be found in the form of mounds and shell middens, pottery sherds and stone tools (Hoag, 1956). Sites with evidences of Indian occupation are most frequently found along stream courses, high dry areas along bays and on coastal islands (Martin, 1962).

European settlement of the region began with the Spanish in the St. Augustine area in the mid-1500's (Brown, 1948). The English arrived later, failing to establish colonies at first, but finally

succeeding in the late seventeenth and early eighteenth centuries. Expansion along the coastal area of the Carolinas progressed rapidly and by the late eighteenth century the area was essentially completely European (Clay et al., 1975). Settlement of the coast as far south as St. Augustine was completed by 1820, and as far south as Cape Canaveral by the end of the nineteenth century (Dept. of the Interior, 1970). Cities like Wilmington, Charleston, Savannah and St. Augustine were all fairly well developed urban centers by the early nineteenth century.

As a result of the early development of the region in American history, there are innumerable roads, trails, structures and sites of historic importance. This is reinforced by the additions of sites associated with the Civil War.

The most recently developed area is southern Florida, where settlement and development is to a large extent a product of the twentieth century, and where in places such as the NASA space center at Cape Kennedy important historic sites date back only a few years.

(3) Summary of known cultural resources

There is at present only one known National Register or Eligible Site in the OCS Area covered by this study. The wreck of the ironclad warship "U.S.S. Monitor" is located in a NOAA administered marine sanctuary about 26 km south-southeast of Cape Hatteras Light. Table G-29 contains a list of National Register Sites, National Register Eligible Sites (as of May 4, 1976) and other sites on state registers or of state interest which are, as much as it is possible to determine from maps, directly on the coastline, or in state waters within the region. Many of these are represented on Visuals 1N and 1S.

(4) Summary of the unknown cultural resources

Except for a small percentage of the shipwrecks probably in this OCS area, very little is known of the location and numbers of vessels sunk along the South Atlantic coast. Earlier vessels, lacking communications equipment must have sunk without word ever being sent as to the location of the wreck. Vessels are often abandoned before sinking, leaving the ship to finally go down, after drifting, in an unknown location. A knowledge of the location of a sinking is frequently not the location of the wreck, which may float beneath the surface for some time, or which may slide along the bottom due to the effects of storms or currents.

Even less is known about living sites beneath Atlantic waters. That sea level was lower than at present in various stages of glaciation during the Pleistocene has been fairly well documented by various sources from different parts of the world. The exact amount of sea level depression is still limited to estimates. Assigning a date 12,000 B.P. for the arrival of Paleo-Indians in the coastal area would mean sea level was approximately 40 m below the present level (Coastal Environments, Inc., n.d.). Simply put this would mean that areas presently under 40 m (131 ft.) of water or less would have been dry land surface. Certain things complicate the picture, however. Geologic changes in the level of the surface are important. A particular part of the sea bed may have risen 20 m while sea level rose 40 m (131 ft.), leaving the area now under only 20 m (66 ft.) of water. Likewise, if an area has been geologically depressed, say 20 m (66 ft.) the once dry land surface will now be 40 m (131 ft.) plus 20 or 60 m beneath present sea level. Using the simplest assumption, that sea level was depressed about 40 m and therefore all sea floor covered by 40 m or less was exposed, a broad plain roughly 80 km (50 miles) wide could be added to the present coastline (Coastal Environments, Inc. n.d.). Since we find a high concentration of Indian living sites near the coast today, we might assume that Paleo-Indians likewise tended to live along the coastline. This would put possible Paleo-Indian living sites out as far as the present 40 m (131 ft.) depth line, about 80 km (50 miles) into the Atlantic near Georgetown, S.C., 95 km (59 miles) out at Savannah, Ga., and 106 km (66 miles) out at Brunswick. No sites are known at present, rather geologic and archaeological evidence points to the possibility of underwater sites. A detailed study should be carried out along the South Atlantic OCS region to determine geologic trends, in order that a more accurate estimation of the approximate extent of dry land during Paleo-Indian and later times. Until such a time as the study is completed and a more authoritative depth than the 40 m postulated herein determined, all tracts proposed for leasing will have to be considered capable of containing prehistoric living sites. Currently it is generally presumed that the potential for encountering cultural resources material (shipwrecks and paleoenvironments) will increase as one moves closer to shore, especially off major riverine systems.

Table G-29. National Register Sites, Sites Eligible for the National Register and Other State Sites

North Carolina

Currituck Beach Lighthouse
Wright Brothers National Memorial
Nags Head Woods
Fort Macon
Gibbs House
Jacob Henry House
Cape Lookout Light Station
Fort Fisher
Bold Head Light House
Fort Caswell

South Carolina

Chapin Company
The Hermitage
Cedar Hill
Sunnyside
Atalaya
LaBruce-Lemon House
Pawley's Island Historic District
E. C. Boyle House
Bartol-Calhoun House
Winyah Bay Jetties
Bull's Island Fort
Crow Island
U. S. Coast Guard Historic District
Mt. Pleasant Historic District
Castle Pinckney
Battery Thomson
Ft. Sumter National Monument
Battery Gasden
Ft. Johnson
Stiles - Hinson - Thompson House
Seabrooks Beach Battery
Presbyterian Manse
Nell S. Graydon House
Edisto Beach Battery
Coffin House
Ft. Gilmore

Table G-29 (continued)

Fort Walker
Easterbrook Battery Braddock Point
Bloody Point Lighthouse

Georgia

Fort Pulaski National Monument
Eugene O'Neill House
St. Simons Lighthouse Keepers Building
Strachan-Stuckey House

Florida

Fort Clinch
Spanish Coquina Quarries
Turtle Mound
Ponce de Leon Inlet Lighthouse
Spanish Fleet Survivors and Salvors Camp Site
House of Refuge at Gilbert's Bar
Bingham-Blossom House
Mar-a-Lago National Historic Site
Cape Florida Lighthouse

In addition to the sites listed for Florida, numerous historic shipwrecks have been exactly or approximately located in state waters along the Florida coast. The are illustrated very generally in Figure G-5.

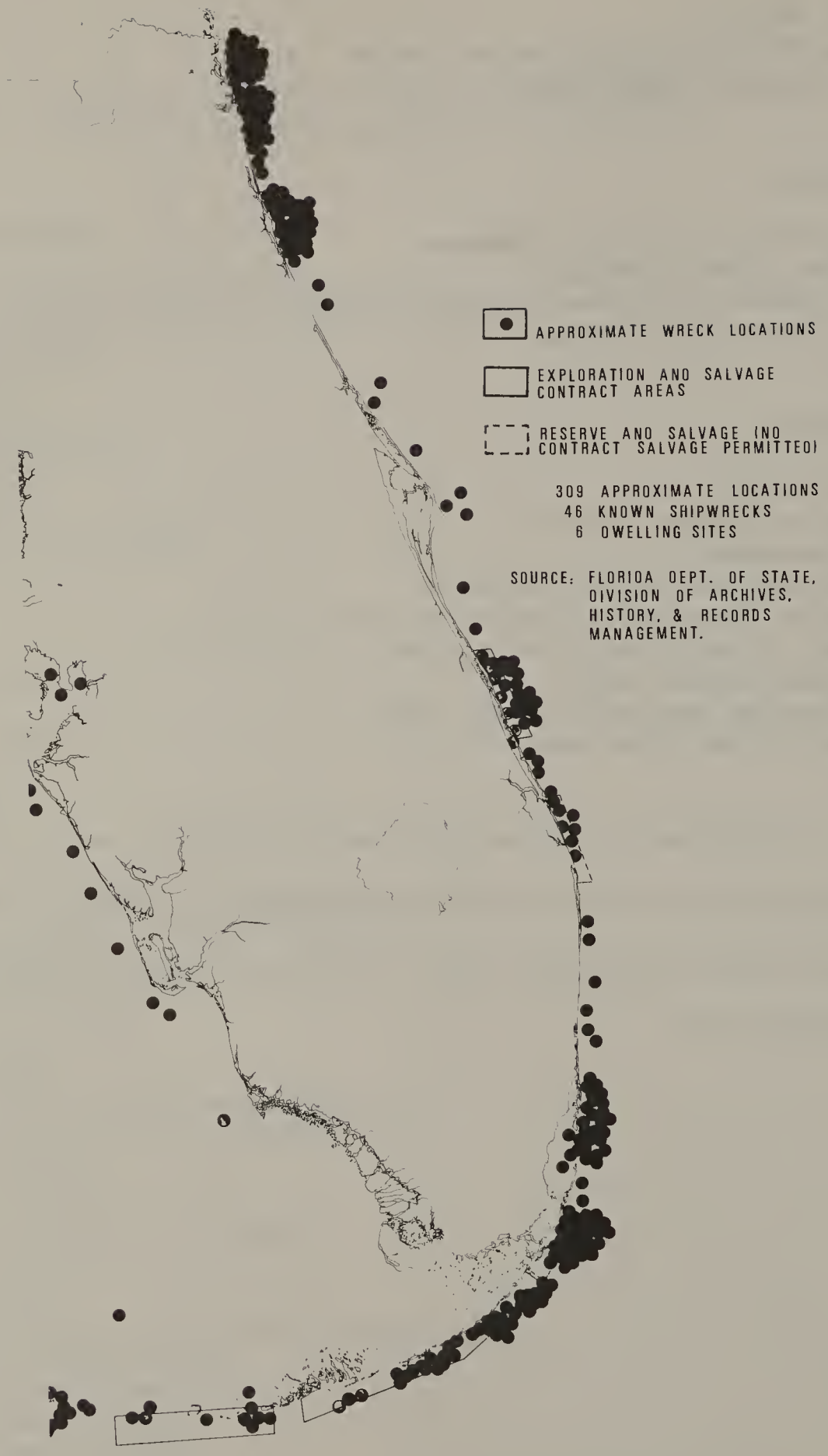


FIGURE G-5 SHIPWRECKS IN FLORIDA COASTAL WATERS

On land far more is known about historic and archaeological sites, however more is constantly being discovered. As man explores the coastal area more throughly more and more sites will come to light. The National Register list is constantly expanding and any OCS related operation on shore will have the potential of unearthing archaeological sites.

7. Solid Waste

Solid waste management is considered a state and local problem. The Federal government has no jurisdiction over disposal practices at other than Federal installations. It does provide grants for research and the development of new methods of collection and disposal and purchases recycled materials. It has, in the past, funded demonstration projects for new technologies and has tried to eliminate discriminatory interstate transportation rates.

Most states require regional or county management plans specifying conditions and future alternatives. Regions and counties are urged to cooperate so as to share the financial burden and maximize the use and efficiency of disposal facilities. The problems are most acute in population centers where density is high, waste volumes are large, and disposal sites are scarce.

Estimates of the amount of solid waste generated per person range from 3.3 lb/day to 6 lb/day (Snyder, 1974; CEQ, 1974). The 3.3 lb/day figure includes wastes generated in households, commercial and business establishments and institutions. Higher figures include those generated by industrial processes, agricultural, construction, demolition and sewage wastes.

More than 90% of the solid wastes are directly disposed of on land, in open and burning dumps, or sanitary landfills. Other methods of disposal are incineration, use of materials to build such things as artificial reefs and collection and recovery. Sanitary landfilling, the preferred method involves the disposal of solid waste on land by spreading them in thin layers, compacting them to the smallest practical volume, and covering them with soil. This method is employed by a majority of communities. Following is a description of the methods employed by the southeast Atlantic states.

There are three acute problems that have resulted from solid waste disposal. In landfill operations ground waste pollution has resulted because of the high water table. This is caused by leaching material entering the ground water aquifer.

8. Land Use

The Virginia Institute of Marine Science (VIMS) study prepared for BLM in 1974 groups the coastal counties between Cape Hatteras and Cape Kennedy into ten sectors for more convenient discussion. The following discussion is based upon the VIMS data with additional information adapted from the USDA Soil and Water Conservation Needs Inventories for each state and from the U.S. Census of Agriculture.

a. North Carolina

Sector 1: This section of the North Carolina coast is comprised of Dare, Hyde, Beaufort, Pamlico, Craven and Carteret counties (Figure G-6). These six counties are outside of the mainstream of coastal plain development, and, with soils unsuited for intensive farming they are in general heavily forested. Sixty-nine percent of the land in Sector 1 is in commercial forest, and in addition much of this forest is on wetlands which in turn comprise more than 50% of the 0.9 million hectare area.

At least 26% of the wetlands, forest and barrier islands in both public and private ownership are dedicated to recreation or conservation purposes. Table G-30 summarizes the major areas devoted to these uses (see Visual No. 1N).

Federal ownership of non-cropland in these six counties is estimated to be 9.8% of the total area. The urban and built-up land use category covers approximately 1.6% of the total area. Estimates of Federal non-cropland ownership and areas of urban and built-up lands are derived from: USDA, SCS, Land & Water Conservation Needs Inventory for each South Atlantic State, published in 1971.

Nineteen percent of all land was in farmland in 1969, as opposed to 21% in 1964, representing a decline in farmland in all counties except Hyde.

The Pamlico Sound area is largely rural, with Dare, Hyde and Pamlico counties having no urban population. Craven County, the most populous of the six counties had a 1970 population of 62,554 of which 55.2% was urban New Bern is the only urban center in that county. Beaufort County had a 1970 population of 35,980, of which 24.9% was considered urban. The town of Washington in Pamlico County is its only urbanized area. More-

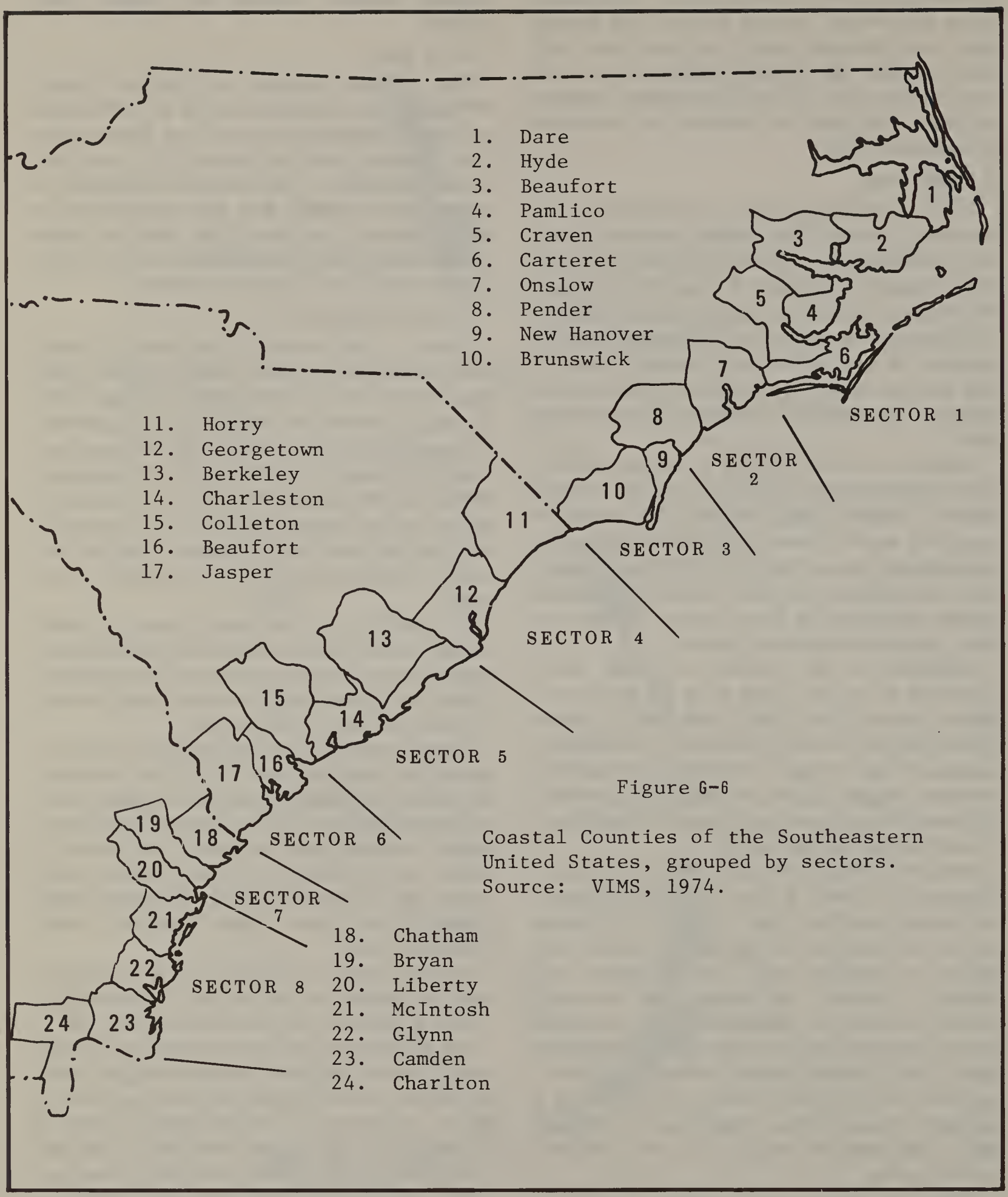


Figure G-6

Coastal Counties of the Southeastern United States, grouped by sectors. Source: VIMS, 1974.

Table G-30 Selected Recreation or Conservation Areas in North Carolina

Cape Hatteras Nat. Seashore	13,153	hectares
Cape Lookout Nat. Seashore (proposed)	10,117	"
		23,270
Matamuskeet N.W.R.	20,307	
Pea Island N.W.R.	12,780	
Swan Quarter	16,163	
Cedar Island	5,069	
		54,319
Croatan National Forest		61,656
Gull Rock State Wildlife Mgr. Area		7,631
Fort Macon State Park		157
Goose Creek Game Land	2,873	
Dare Game Land	62,783	
Big Pocosin Game Lane	9,759	
		83,046

head City is the only urban center in Carteret County. The population of that county is 31,603, of which only 27% is urbanized.

Sector 2: Onslow and Pender are largely rural counties, with as much as 50% of their land in wetlands and 79% in commercial forest areas. The entire coastline of these two counties is protected by a series of narrow barrier islands. The hinterlands of these islands are for the most part marshes which are separated from the drier mainland shore by the Inter-Coastal Waterway.

Approximately 20% of Onslow County is taken up by Camp Lejeune U.S. Marine Reservation, which is located around the large natural bay created by the New River. Hammocks Beach State Park occupies 361 hectares in Onslow County. Pender County is best known for its Holly Shelter State Game Land and Angola Game Land which together occupy 30,757 ha of predominantly wetland areas.

Federally owned non-cropland for this sector is approximately 8.3% of the area, nearly all in Onslow County, and the urban and built-up area is approximately 1.7%.

Between 1964 and 1969 land in farms declined 13.8% although there was a slight increase in total cropland (0.4%).

Onslow County, although largely rural, owes its relatively high population of 103,125 to Camp Lejeune. Jacksonville is located near the military reservation and is the county's only urban center. Pender County, like Onslow County, is rural and contains vast forest and wetland areas.

Sector 3: New Hanover and Brunswick counties continue the characteristic pattern of swampy, forested coastal flatlands. Soils are generally of poor quality for farming. Approximately 78.6% and 46.2% of all land in Brunswick and New Hanover counties, respectively, is in commercial forest. Here, as in other coastal counties, forests provide the raw materials for an extensive pulp, paper and wood products industry. New Hanover County has proportionately less forest area because it is more highly urbanized than the adjoining coastal counties. Wilmington, the primary city, owes its growth largely to its strategic port location 32 km north of the mouth of the Cape Fear River. The river has an 11 m (36 ft) navigation channel which is maintained by regular dredging.

The amount of land in farms increased slightly from 12.8% to 15.2% in New Hanover County between 1964 and 1969 and decreased from 17.9% to 15.9% in Brunswick County. For this sector, the net change in farmland was a 9.5% decline and an 8.5% drop in cropland.

Lands under environmental protection or management are the Masonboro State Park (178 ha) on Masonboro Island in New Hanover County and the Eagle Island Game Land (809 ha) in Brunswick County. The excellent beaches along the coast of both counties have been experiencing a growth in the construction of second homes and low profile hotel and motel facilities in recent years.

Federally owned non-cropland makes up 2.2% of Sector 3 with the urban and build-up category accounting for 6.3% of the area.

New Hanover County is the most highly urbanized of the North Carolina coastal counties. Sixty-nine percent of its 83,000 population is urban and is located in the rapidly growing port city of Wilmington, the only North Carolina city along the coast which is classified as a regional center. Urban and suburban growth has spread over most of the northern half of the Cape Fear peninsula as far as Route 17. The river front, from the northern city limit of Wilmington southward for about ten kilometers is largely taken up by port facilities, warehousing and oil storage terminals. Large new industries have been expanding north towards Castle Hayne and northwest between the Northeast Cape Fear and Cape Fear rivers into Brunswick County. Resort and second home development is occurring in the Wrightsville Beach and Caroline Beach areas, as well as along the Intracoastal Waterway and the lower Cape Fear River. Smith Island, at the southern tip of the peninsula, is currently being proposed as an exclusive private resort community, but this is vigorously opposed by conservation groups.

Brunswick County is largely rural, its only urban center being Southport at the mouth of the Cape Fear River. It is the site of a new nuclear power plant constructed in 1972 and a proposed Pfizer chemical plant.

New Hanover County has nearly 100 manufacturing firms of which all but six are located in Wilmington. Forest products, cement and cement products, asphalt, textiles, processed foods, packaging, chemicals and fertilizers are the most commonly produced items. In Brunswick County, eight manufacturing firms produce textiles, ce-

ment, fish products, building materials, wood products, chemicals and machine parts.

B. SOUTH CAROLINA

Sector 4: Although large land areas in Horry and Georgetown counties are wetlands, they are well defined along the rivers which drain them (Fig. G-7). The Little Pee Dee, Pee Dee, Black and Sampit rivers are tributaries of the Waccamaw River. The latter flows south-southwest from Lake Waccamaw, its source in Brunswick County, into Winyah Bay, Georgetown County. Below Winyah Bay, another major river, the Santee, forms a marshy delta where it flows eastward into the Atlantic. This two-county sector is sparsely developed with 70% of the land in forest, 69% is classified as commercial forest.

In 1969, 36.7% and 13.0%, respectively, of this land in Horry and Georgetown counties, was in farms. This represents a sharp decline from 43.7% and 24.3% in 1964. Environmental use or management areas along the coast include Huntington Beach and Myrtle Beach State parks, totaling 1,138 ha. Five game management areas, Gapway Bay, Kilsock, Pee Dee, Biust, and Waccamaw comprise another 19,979 ha. Of these, all but the Pee Dee Game Management area (516 ha, owned by the South Carolina Wildl. and Mar. Res. Dept.) are owned by paper companies. Another large area, Hobcaw Barony (7,082 ha) on the Winyah Bay in Georgetown County, is owned by a private foundation and operated by Clemson University for research and education in forest and marine resource management. Another 232 ha at Myrtle Beach are devoted to the South Carolina Agricultural Experiment Station.

Federally owned non-cropland in this sector is only 0.3% of the total area and urban and built-up land comprises 4.9%. Between 1964 and 1969, land in farms declined 24.7% and total cropland decreased by 1.9%.

Horry and Georgetown counties are best known for their resort areas of Myrtle Beach and the "Grand Strand". Horry County has a population of 70,000 of which 29.5% is urban. Georgetown, with a population of 33,500 is 39.6% urban. Conway, North Myrtle and Myrtle Beach in Horry County and Georgetown and Andrews in Georgetown County are the only urban centers considered by the South Carolina State Planning and Grants Division to be primary (as opposed to regional) growth areas in these two counties.

Industrial development in this section, as in other coastal counties with major urban concentrations, is scattered. Because of excellent sandy beaches with a total extent of 75,639 m and an area of approximately 27 ha, recreation and tourism promise to be the biggest industries here. Between 1962 and 1972, employment in the service industries increased substantially, an average of 12.03% and 6.05% per year in Horry and Georgetown counties respectively. In Horry County, employment in services increased faster than any other sector and the rate compares favorably with that of employment growth as a whole which was 8.0% per year. In Georgetown County, the average rate of growth for all employment was 4.26% per year, also lower than the rate of increase in the service sector of the economy. Employment in construction increased as well, but less spectacularly: only 5.54% in Horry and 8.09% in Georgetown.

The two-county area has 13,714 hotel and motel rooms, 7,844 camping sites, eight commercial marinas with a total of 423 berths, 54,000 acres of hunting area, and 26 golf courses.

Sector 5: Berkeley County is sparsely developed, with more than 83% of its land area forested and 14% in farms. Although it has no coastline of its own, Berkeley County was included in the coastal area analysis because it is part of the Charleston SMSA and for much of its length is no more than 16 km from the ocean. It has two outlets to the sea, the Cooper and the Wando Rivers, which flow into Charleston Harbor.

Charleston County has large wetland and coastal marsh areas. Unlike Horry and Georgetown counties, whose beach hinterlands are wide and largely dry, Charleston County has wide marsh areas and an extensive system of marshes, estuaries and inlets. This condition has been created by a number of rivers which drain the inland swamps and meander toward the sea. The marsh is most pronounced at the northern and southern portions of the county, and makes access to many beaches difficult.

Charleston County, which has substantial urban development, has only 50% of its land covered with forest and 11.7% of its land in farms. Large sections of Sector 5 have been designated as environmental use or management areas. These include the Francis Marion National Forest (99,642 ha, Charleston and Berkeley counties), which is

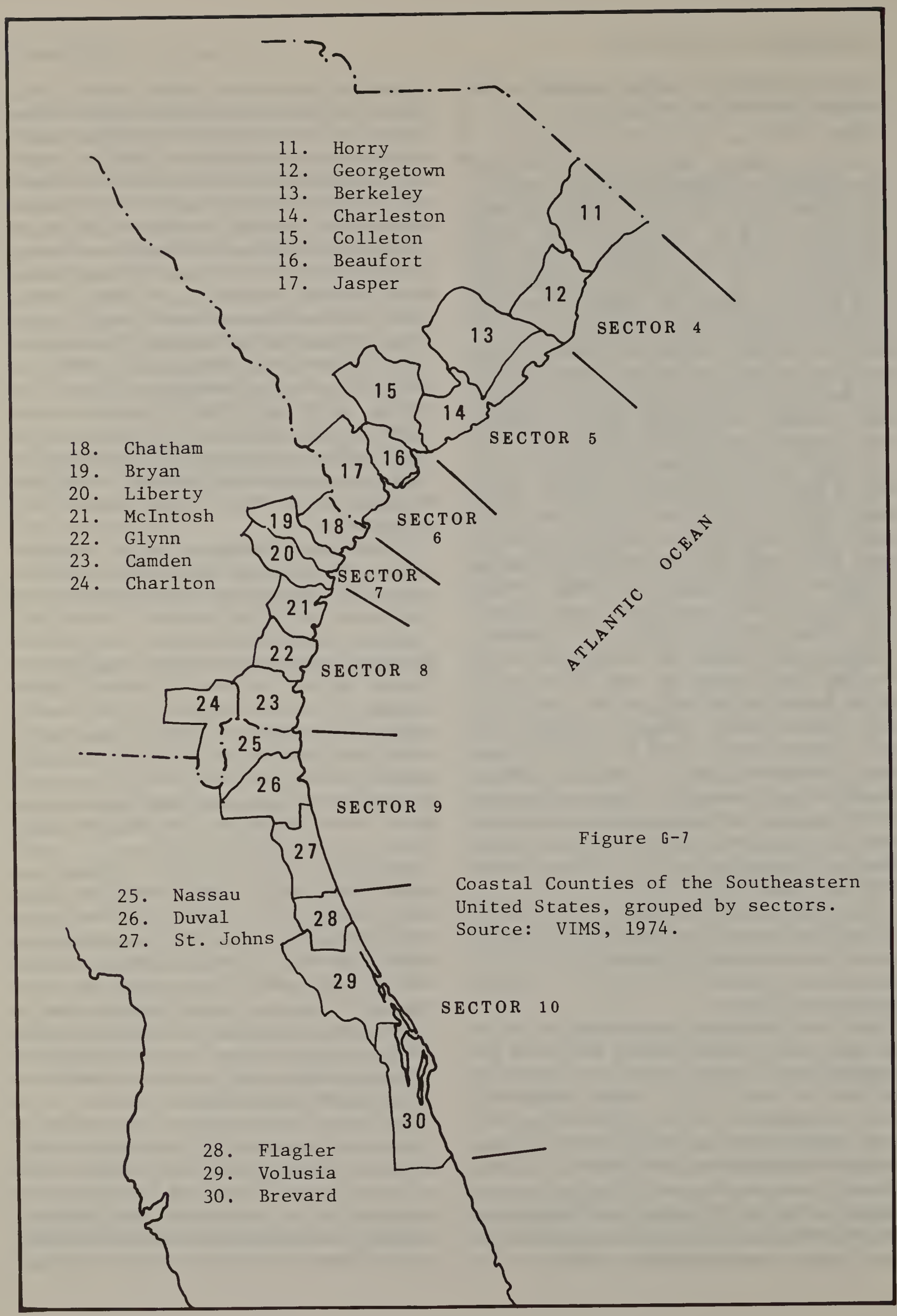


Figure G-7

Coastal Counties of the Southeastern United States, grouped by sectors. Source: VIMS, 1974.

also a game management area; the Cape Romain National Wildlife Refuge (22,285 ha, Charleston County) and Edisto Beach State Park (508 ha, Charleston County).

Federally owned non-cropland rises to an impressive 23.1% in this sector and urban and built-up areas cover a substantial 5.7% of the area. Between 1964 and 1969, the land in farms in this sector declined 30.6% and total cropland declined 11%.

Charleston County, with 82% of its 247,650 population living in the city of Charleston, Mount Pleasant and James Island, is the most populous and urban of South Carolina's coastal counties. Berkeley County has less than one-fourth of the population of Charleston County and its population density is substantially lower: 20 persons/km^2 compared to 102 persons/km^2 in Charleston County. Berkeley County's population is only 45.1% urban and it has two urban centers, Monck's Corner and Goose Creek.

Firms in Charleston County include metal and machinery manufacturing, printing, food and seafood processing and packing, textile, wood products, petro-chemical, fertilizer and building component industries. Shipping, trade and warehousing are important port-related activities.

Tourism is important in this area, with beaches and historic Charleston attracting many vacationers. There are two historical parks in the area, Charles Towne and Old Dorchester, beautiful gardens and historic sites such as Drayton Hall and Hampton Plantation which contribute to the tourist economy of the area.

Charleston County has 32 km of beach and 75 ha of beach area. There are 3,075 hotel and motel rooms, 1,087 camping sites, 11 golf courses, 590 marina berths and 49,245 ha for hunting. In 1972, 2.4 million vacation and/or weekend person-trips were made to the area, of which 78.5% were made by non-South Carolina residents.

Sector 6: This sector characterized by its vast system of coastal rivers, marshes, waterways and islands, most of which is undeveloped and inaccessible except by boat. Beaufort is an exception lying at the center of a large group of marshy islands which include St. Helena, Ladies, Port Royal and Parris. The area includes two military reservations. The northeastern end of Helena Island contains the 2,023 ha Hunting Island State Park.

The South Edisto, Combahee Bull, Coosaw, Beaufort, Broad, Chechesse, Colleton and May rivers converge in this area, along with countless other streams and creeks.

Approximately 50% to 60% of the counties in Sector 6 are in wetlands. Sixty-four percent is forested and 30% is in farms. Between 1964 and 1969, land in farms declined 19.9% and cropland decreased by 5.6%. Federal non-cropland makes up 1.4% of this sector, and urban and built-up lands cover 3.8%.

The Savannah National Wildlife Refuge (2,925 ha) is a notable environmental management area located on the Savannah River about 24 km from its mouth.

Colleton, Beaufort, and Jasper counties are largely rural. Beaufort County, with a density of 15 persons per square kilometer, owes its population of 51,136 largely to the Marine Corps bases near Port Royal and Beaufort, which are the only urban settlements in the county. Twenty-three percent of Colleton's 27,622 population is located in Walterboro, the county's only urban center. Jasper County, where the population is just under 12,000, is rural.

Tourism plays a smaller role in Sector 6, with only 619,727 vacation/weekend person trips recorded for 1972. Of these, less than 50% were generated by out-of-state tourists. Beach length has been measured at 29 km, with 154 ha of beach area. In 1972, there were 885 hotel and motel rooms available to tourists, as well as 371 camping sites. Six marinas provide 215 berths. In addition, there are 13 golf courses and 14,974 ha of land available for hunting. A large part of Hilton Head Island, located at the mouth of the Broad River on Port Royal Sound, has been developed as an attractive and exclusive resort community.

c. GEORGIA

Sector 7: Chatham and Bryan counties are similar to Beaufort and Jasper counties to the north. Broad expanses of marsh, waterways and sounds characterize the coast. The Savannah, Wilmington, Ogeechee and Medway rivers empty into the tidal marshlands along the coast. The city of Savannah is approximately 24 km inland from the sea separated from it by Wilmington and Tybee Islands. Originally built on the dry hammocks which dot parts of this flat and watery terrain, Savannah has had to expand by draining and filling wetlands.

About 62% of both counties is covered by forest. In Chatham County, 8.8% of the land was in farms in 1969, down from 16.7% in 1964. In Bryan County, 11.0% was in farms, down from 12.5% in 1964. Outside metropolitan Savannah, development in both counties is exceedingly sparse. A large part of Bryan County (and adjacent Liberty County Sector 8) is occupied by Fort Stewart Military Reservation and therefore excluded from private development. An expansion of the number of military personnel at this base is presently contributing to some deficiencies in housing and other population related facilities in the surrounding area.

Environmental management areas include Fort Pulaski National Monument (2,233 ha), Savannah National Wildlife Refuge (2,702 ha), and Tybee National Wildlife Refuge (40 ha). The latter two areas are located at the mouth of the Savannah river. In addition Skidaway Island State Park covers 194 ha.

Federal non-cropland ownership in 1969 was 22.4% of the area, with 6.6% in urban and built-up lands. For the sector, land in farms declined 33% between 1964 and 1969 although the total acreage of cropland increased by 16.2%.

Chatham County is the most highly urbanized of the Georgia coastal counties, with 89.3% of its population of 187,767 located in Savannah, three other surrounding municipalities and various unincorporated urban areas. The city of Savannah is located in the extreme north central part of Chatham County, immediately adjacent to the south bank of the Savannah River. The city comprises 37 of the 1,093 km^2 in the county. Most of the older developed portions south of the river are on hammocks of well-drained soils. Some of the later development areas are characterized by poor natural soil fertility and poor drainage.

The relative flatness of the county and the existence of numerous stream channels render it highly susceptible to flooding, especially when extreme rainfall coincides with high tides. East and south of Savannah, Chatham County consists largely of marshland. Additional development constraints are imposed by flat or depressed areas in the western part of the county which have slow surface run-off, heavy clayey sub-soil and/or poor internal drainage. Throughout most of the city and county, site-engineering modifications such as re-contouring, muck excavation and backfilling, and drainage canal construction are usually necessary prior to construction.

Savannah is currently experiencing a decrease in population caused by out-migration of many middle and upper income families into the suburban fringes which offer a higher level of amenities and services.

The 1975 Land Use Plan for Savannah proposes what appear to be a system of infilling as a means of accommodating future urban growth.

The Port of Savannah has been a vital factor in the stimulation of industrial growth and economic progress in the Savannah area and the State of Georgia. Although it ranks only third in tonnage of shipping among the ports of the coast between Hatteras and Canaveral, Savannah leads the South Atlantic coast ports in general cargo and foreign commerce.

Primary industries are wood products, textiles, chemical, asphalt, metal products, machines, building materials, oil refining, food processing and printing. Extensive tourism development is found at Savannah Beach.

Bryan County, south of Savannah, is rural, with large areas of marsh and swampland. More than 30% of the county is occupied by the Fort Stewart military reservation.

Sector 8: Eighty percent of the land in these counties is forested. Only some 8% of the land area is in farms. Brunswick in Glynn County is the only city of appreciable size, with the remaining counties sparsely populated.

Four state parks are located in the area: Crooked River (202 ha, Camden County), Jekyll Island (4,452 ha, Glynn County), Santa Maria (26 ha, Camden County) and Stephen C. Foster (32 ha, Charlton County). Other environmental management areas include the Altamaha Waterfowl Public Hunting Area (12,141 ha, McIntosh County), Fort Frederica National Monument (82 ha, McIntosh County), R. J. Reynold State Wildlife Refuge (7,285 ha, McIntosh County), Harris Neck National Wildlife Refuge (1,087 ha, Liberty and McIntosh Counties), Okefenokee National Wildlife Refuge (138,003 ha, Charlton County), and the Wolf Island National Wildlife Refuge (218 ha, McIntosh County). Cumberland Island, one of the largest barrier islands, is located opposite the Camden County mainland and is a National Seashore.

Federally owned non-cropland accounted for 15.5% of the area in 1969, with urban and build-up acreage totaling 1.8%. During the census period 1964 and 1969, land in farms dropped a

total of 42.4% although total cropland declined only 4%.

The combined population of Sector 8 (Liberty, McIntosh, Glynn, Camden and Charlton counties) is less than 100,000. Glynn County, with a 1970 population of 50,373, houses the city of Brunswick, the most important urban center on the Georgia coast outside of Savannah.

Approximately 30% of Liberty County is occupied by the Fort Stewart military reservation in the northwest, effectively precluding civilian development of the area. It accounts for a large share of the population of 17,569. Hinesville is the only urban area. Only 4.35% of the total county land is developed.

McIntosh County is rural, with a population of 7,371 persons. The largest town is Darien, a fishing town on Cathead Creek. Of the total county land area, 8.2% is developed.

Glynn County occupies 6,838 ha, of which 5,103 ha are marsh and water. Other settlements in the Brunswick area are Saint Simons Island, Sea Island and Jekyll Island, which recently have developed or redeveloped as year-round recreational communities. Of the county's total area, 7.35% is developed. The Blythe Island Naval Reservation occupies 4,059 ha of land to the west of Brunswick.

Glynn County has experienced a relatively high rate of growth within the past ten years. The primary growth areas are Saint Simons Island, Blythe Island on the Turtle River, and the urban fringe areas of Brunswick. Most of the commercial establishments in the county are located along U.S. Highway 17, U.S. Highway 341 and in the village of Saint Simons Island. Concentrated areas of commercial strip or spot type development are found along Highways 17 and 841. Only 60 ha are currently used for industrial purposes, primarily along the Turtle River and Southern Railroad; 7,067 ha are zoned for industrial uses. Of these 4,488 ha are marsh and low lying land not suitable for industrial use. Of the remaining 2,578 ha, 1,619 ha are available for industrial uses.

Camden County's population is 11,334. A single urban center, St. Marys, is located on the St. Marys River which forms the boundary between Georgia and Florida. The only other settlement having a population greater than 1,000 is Kingsland, which is located further inland on Route 17 and the Seaboard Coast Line Railroad. Only 7.35% of the total area of the county is developed.

Cumberland Island, a large barrier island stretching from St. Andrews Sound to the mouth of the St. Marys River, is a National Seashore. On the island itself only minimal development, such as camping areas for backpackers and facilities for daytime use of the beaches, will be permitted. However, substantial tourism development is expected to occur on the adjacent mainland.

Charlton County is rural, with a population of less than 6,000. Folkston, the best known of its communities, is the starting point for visits to the Great Okefenokee National Wildlife Refuge. It is being promoted as the west leg of "Georgia's Golden Triangle", the other legs of which are Waycross, the gateway to Okefenokee's Swamp Park, Brunswick and the Golden Isles.

The State of Georgia has only recently begun participating significantly in the growing nationwide tourism industry. While studies have shown that Route 17 is a major tourist route along the eastern seaboard and over five million people per year travel this highway, the majority of vacation and recreational traffic passes through the area. Only the Savannah, Brunswick, Jekyll and Saint Simons areas gain any major advantage as a destination point. The completion of I-95 has drawn traffic from Highway Route 17 in sufficient numbers to cause some significant localized economic problems. Efforts are being made by state and regional planning agencies to better utilize the tourism potential of Georgia's natural and historical resources.

D. FLORIDA

Sector 9: Eighty-three percent of Nassau County is covered by forests which provide the basis for its primary industry, pulp and paper. Of its total land area, 15.7% was in farms in 1969. Similar statistics for Duval and St. Johns counties are 60% and 75% forest area and 15.2% and 17% in farming, respectively. The topography, soils, and other natural characteristics are similar for all three counties. Development is sparse except for the concentration in the heavily populated Jacksonville area and the resort-oriented urban centers of St. Augustine, Jacksonville Beach and Fernandina Beach.

The terrain is level with the sandy soils characteristic of the dry areas of the coastal counties interspersed with swamp. Tidal marshes, islands and estuaries are found extensively between the barrier islands and the mainland north of the

mouth of the St. Johns River. Here, the marshes extend inland 16 to 24 km along the St. Marys, Nassau and St. Johns river, which drain the swampy forests to the west.

The western third of Nassau County, bounded by the Little St. Marys River to the north-northwest, Boggy Creek and the Nassau River to the south, and Route 17 to the east-northeast, is in forestry and game management areas. The estuarine northeastern portion of the county is within the hurricane flood zone and is unsuitable for development. The St. Marys and St. Johns rivers, their tributaries, coastal marshlands, and the ocean three miles offshore above the St. Johns River have been established as Florida Aquatic Preserves which prohibit development which will harm the natural environment of the aquatic system. Large areas between Lofton Creek and the coastal marshes and smaller areas to the west have been established by the Florida Coastal Plains Coordinating Council as suitable for future intensive development.

South and east of the St. Johns River, where there are no west/east flowing rivers, the coastline changes markedly. For some 29 km there are no barrier islands, except those artifically formed by the digging of the Intracoastal Waterway some 3 km inland. It is not until Lake Ponte Vedra, the Tolomota River and the Matanzas River, that the barrier island coastal configuration is reestablished. The salt marshes backing these islands are few. However, the inland portion of this area, composed of St. Johns and Duval counties, which may be termed a peninsula of sorts, is primarily swampland and sparsely developed.

Of the presently undeveloped land remaining in Duval County, about 20% is deemed suitable for intensive development with corrections. The remainder is earmarked for conservation and preservation, with compatible development permitted in some areas. Approximately 80% of St. Johns County is designated as marginal land. Limited areas near Route I-95 and Route 16, east of Tocoi Creek, along Routes 206 and 305, and west of the Matanzas River, have been designated as suitable for intensive development with corrective action.

Two state parks in Sector 9 are Fort Clinch on the northern end of the Amelia Island and Little Talbot Island State Park on the island of that name.

Federally owned non-cropland in this sector is 2.1% of the total area, and urban and built-up lands comprise 5.8% of the total. Land in farms declined 22.3% between 1964 and 1969, although total cropland actually increased by two percent.

Nassau County, with its population of 60,626, is only 33.7% urban. It is largely composed of forest interspersed with swamp areas. Its only urban center is Fernandina Beach, located at the northern end of Amelia Island. The island, which is approximately 24 km long, is accessible by car for most of its length and is well known for its fine ocean beaches. One of the most recent developments there is the Amelia Island Plantation resort community, which, in concept, resembles the low profile, exclusive resort communities built recently on the larger barrier islands in Georgia and South Carolina.

Duval County is by far the most populous of the coastal counties between Hatteras and Canaveral. Its population is 528,865, of which 97.9% is urban. Jacksonville is a regional urban center and a major port whose shipping tonnage exceeds 11 million short tons per year. The city is situated at a bend in the St. Johns River where it turns south. Although Jacksonville's industrial growth was uneven in the 1960's, manufacturing as a source of employment has grown in importance and diversity. Nearly 13% of all employment is in manufacturing of durable goods and food products, paper, printing/publishing, chemicals, and allied products and other non-durable goods. Motor freight and warehousing, as well as wholesaling and distribution are important employment sources.

Industrial sites are located primarily along the northern and western shores of the St. Johns River, along the Seaboard Coast Line Railroad and the Southern and the Atlantic Coast Line Railroad, within the limits of the Jacksonville Beltline. Future industrial development is being encouraged to expand to the south along I-95, Phillips Highway and Florida East Coast Railway as well as along the above-mentioned corridors, but beyond the Beltline.

Other urban development has occurred along the coast at Jacksonville Beach. The beaches in Duval County are all accessible by road and have been built up with resort hotels, motels and private homes. Little Talbot Island State Park offers daytime visitor facilities and picnic areas.

St. Johns County has a population of 30,727, of which 40.2% is urban. St. Augustine, located on the Mantanzas River and the Intracoastal Waterway is the largest city. Much of the area behind the coastal beachfront is wooded and swampy. The coast and parts of the St. Johns River are readily accessible; recreation and tourism are an important sector of the economy, encouraged by the historic attractions of St. Augustine.

Sector 10: Flagler, Volusia, and Brevard counties are 84%, 68% and 19% covered by forests, respectively. The corresponding figures for the proportion of land in farms are 29.4%, 32.8% and 35.3%. Intensive development in these counties in the past has occurred only in the ocean resorts and in De Land to the west. For the sector, land in farms declined by 16% between 1964 and 1969, and total cropland fell by 32.4%. Federal ownership of non-cropland totals 8.1% of the area, and 5.8% of the area is urban or built-up.

Large portions of the counties are considered marginal lands unsuitable for development. Along the coast are areas which are within hurricane floodplain zones. Beginning in central Volusia County, broad coastal marsh areas begin to reappear between the barrier islands and the mainland. In Brevard County, the greater part of Merritt Island has been designated as a wildlife refuge, but this does not preclude its use for aerospace installations at the John F. Kennedy Space Center. The Indian River to the north of the island and east of the Intracoastal Waterway has been designated as a Florida Aquatic Preserve.

In the three-county sector, vacant land deemed suitable for future development is generally limited to narrow strips adjacent to existing developed areas.

Flagler County, which contains large areas of swamp land, is sparsely populated. Its density is only 9 persons per square mile and its total population was below 5,000 in 1970. Its beaches are still sparsely developed, except for Flagler Beach in the southeastern corner of the county, which adjoins Ormond Beach, a part of the Daytona Beach complex.

Volusia County is well known for its extensive tourism development and beaches; Daytona Beach, Ormond Beach, and New Smyrna Beach form a continuous belt of tourist and second home developments along the coast. The highest point of concentration is at Daytona Beach. Another important urban center is De Land in the western section of the county.

Future development of an 80,000 acre tract along the coast between Daytona Beach and St. Augustine is expected to change the character of Flagler and Volusia counties by introducing a population increase of up to 750,000 by 1980.

Brevard County is noted for the John F. Kennedy Space Center and related industries at Cape Canaveral. The only urban center in Brevard County north of Cape Canaveral is Titusville.

Immediately to the south of Cape Canaveral are the large resorts centering on Cocoa Beach, which serve as the residential and services areas for the huge aerospace complex.

H. Water Quality

1. Introduction

The southeast Atlantic states—North Carolina, South Carolina, Georgia and Florida are presently developing Water Quality Management Plans pursuant to Section 303e of the 1972 Amendments of the Federal Water Pollution Control Act (P.L. 92-500). The basin plans may affect local water pollution control activities by identifying polluted waters, establishing maximum pollution loads which may be discharged into waters, identifying waste water treatment plants which are discharging more BOD (Biological Oxygen Demand) than the waters can safely accept, and suggesting measures which would correct local water pollution problems. Point source dischargers are required to obtain a permit which specifies the allowable constituents and amounts of its effluents..This permit program is administered by EPA or by authorized states that have met certain requirements.

Each state is divided into hydrological units (basin) (Figure H-1), which are further divided into segments or sub-basins.

The sub-basins are classified as either water quality or effluent limited. The water quality segments require a significant point source or non-point source to be controlled beyond the best practical treatment or secondary treatment to achieve standards. The effluent limited segment is and will continue to meet water quality standards by the "best practicable control technology" or secondary treatment for publicly owned facilities. Figures H-2 thru H-5 indicate the segment classifications for each state. However, Georgia has not adopted this method. Instead, it classifies each discharge rather than the segment as a whole, and has identified and numbered all of the remaining stream segments in the state. This designation does not mean that every discharger has the same classification.

In contrast to effluent standards, the 1972 amendments to the Federal Water Pollution Control Act (P.L. 92-500) establish water quality standards. The primary difference is that water quality standards involve a calculation of the maximum amount of wastes which can be safely discharged into water.

In implementing the plan for waste load allocation, effluent discharge parameters for individual point source discharges have been established. The reasonable background values are defined as: DO (Dissolved Oxygen) 85% saturation, TKN (Total Kjeldhl Nitrogen) 1.3 mg/l maximum; BOD 4 mg/l. Significant point source discharges are any discharges that have effluent of 100,000 gallons per day or more and/or discharges that are associated with a significant water quality violation problem.

2. North Carolina Basins

There are four coastal basins in North Carolina (Figures H-1 and H-2), Tar-Pamlico, White Oak, Cape Fear, and Yadkin. Table H-1 indicates a summary of major discharges in these areas. There is a special state regulation 2-79 (1975) that prohibits future discharge into coastal waters that have "SA" (shellfishing area) designation. Publicly owned facilities that have been discharging prior to this regulation must comply with the regulation except by special decision of the Environmental Management Commission.

There are only a few population centers on the coast of North Carolina. The northern most coastal area Chowan and Tar Pamlica and Neuse Basins are sparcely populated, however some resort areas development is continually increasing. If development continues at an accelerated rate, water quality problems could result unless adequate controls are met.

The White Oak and Cape Fear Basins have several major population centers which presently do not have adequate waste treatment facilities. Camp Lejeune Marine Base, Jacksonville, Morehead City, Beaufort and Newport are presently either constructing new facilities or upgrading present facilities to provide adequate treatment by July, 1977.

The White Oak Basin has a non-point source problem from a large farming operating which is causing run-off into waters that are classified for shellfish harvest.

The areas which are used for recreations do not have adequate treatment facilities. There are in the Chowan and Cape Fear Basins. The inadequacy occurs during the summer months as a result of the increase in population in these areas.

In general the water quality of coastal North Carolina is good. Those areas that presently have inadequate treatment should be upgraded by July, 1977.

3. South Carolina Basins

South Carolina has four basins and eleven coastal sub-basins as shown in Figures H-1 and

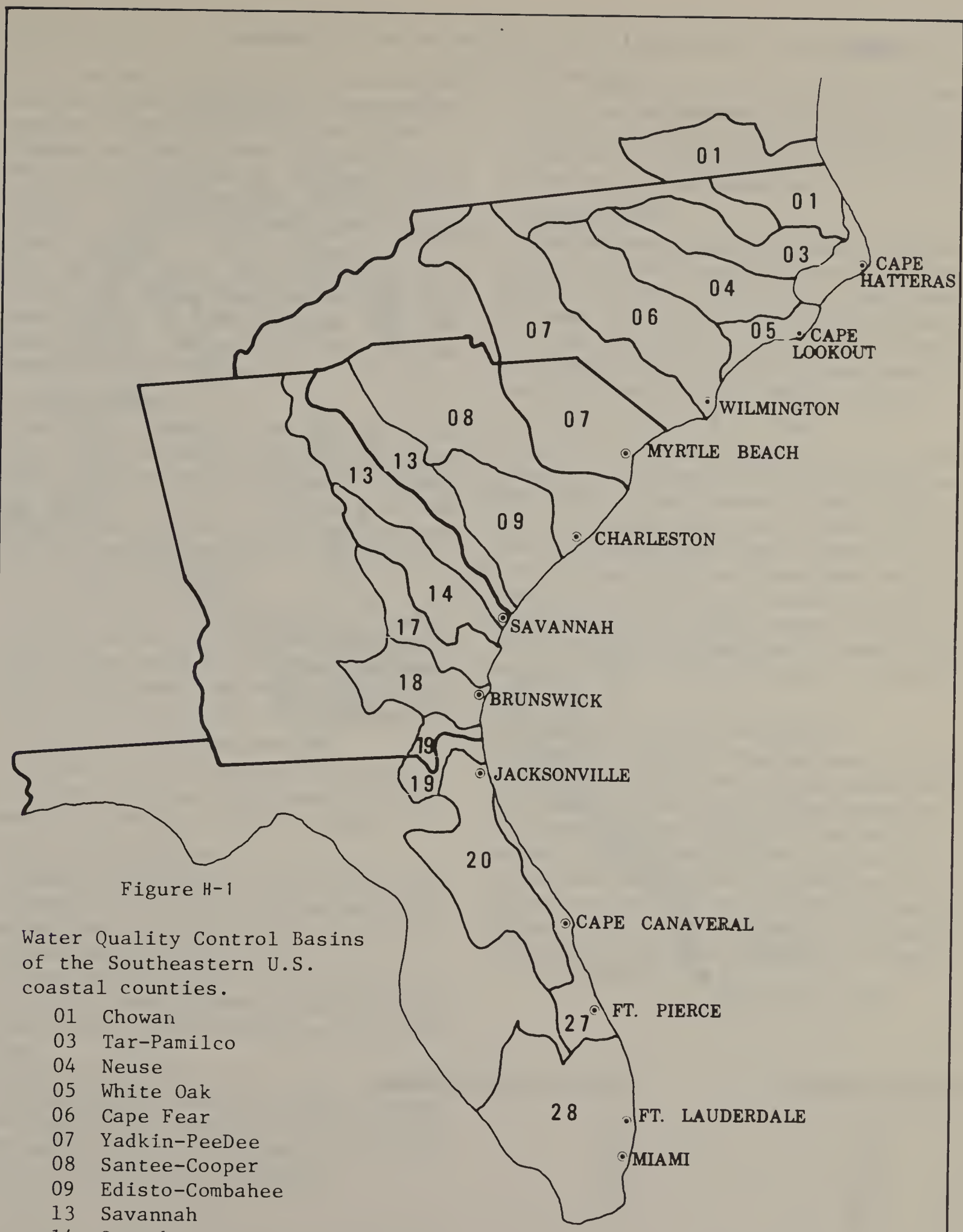


Figure H-1

Water Quality Control Basins of the Southeastern U.S. coastal counties.

01 Chowan
03 Tar-Pamilco
04 Neuse
05 White Oak
06 Cape Fear
07 Yadkin-PeeDee
08 Santee-Cooper
09 Edisto-Combahee
13 Savannah
14 Ogeechee
17 Altamaha
18 Satilla
19 St. Mary's-Nassau
20 St. Johns
27 Florida East Coast
28 Lower Florida

Source: Environmental Protection Agency, 1972.

Figure H-2 Water Quality Classification by Sub-basins for North Carolina



Effluent Limited		Water Quality Limited
54	04	55
50	05	03
52	01	02
53	17	24
51	59	
07		
10		

Source: State of North Carolina. Water Quality Management Plans. Dept. of Natural and Economic Res. Div. of Environ. Mgmt. Environ. Mgmt. Comm. Raleigh, N.C. 1975.

H-3. Basin study plans have been designed for two basins. South Carolina law for water quality standards requires that all waste, prior to discharge into state waters, be treated in a manner which will result in a minimum of 85% reduction of biodegradable matter or an equivalent to maintain conditions under existing water standards.

Of the four major river basins in South Carolina, the Santee-Cooper River Basin was found to have the highest priority value. The general water quality of the South Carolina coastal area is considered good.

4. Georgia Basins

The Georgia coastal area has five river basins (Figure H-1): Savannah, Ogeechee, Altamaha, Satilla and St. Marys. Each of these are divided into Water Quality Management Units (WQMU's). The current water quality standards of Georgia are contained in the Rules of Georgia Water Quality Control, 1973.

A. SAVANNAH RIVER BASIN

Analysis indicates that the biological assessment of water quality in most streams is healthy. The Savannah estuary, has been degraded by individual and municipal waste water discharges.

B. OGEECHEE RIVER BASIN

In general, the water quality characteristics at this point are excellent and present little indication of man's influence on the environment.

C. SATILLA RIVER BASIN

Significant man induced non-point water pollution sources occur in the Woodbine area. This is basically due to failing septic tanks and inadequate disposal of solid wastes.

The general description of water quality in the area is in violation of fishing standards. There is a high coliform count and phosphorus level in this area.

Salt water intrusion into the areas of ground water reserves also cause water quality problems. The Brunswick area has non-point source run-off that results in water quality degradation resulting from problems in solid waste disposal.

D. ST. MARYS RIVER BASIN

The water quality of St. Marys watershed violates stream standards. Violations are most consistent in terms of pH, but occasional contraventions in terms of dissolved oxygen are also likely. This is obviously due to the release of swamp water by natural drainage and runoff into the receiving streams. These swamp waters are supersaturated with CO_2 (H_2CO_3 acid) as they are released into the receiving stream.

5. Florida Basins

There are three coastal basin plans for the east coast of Florida: Nassau-St. Marys, East Coast Florida, and Lower Florida. Each of the basins are divided into segments. The Nassau-St. Marys basin has two coastal segments; Upper Florida east coast (Figure H-4) has nine coastal segments and Lower Florida has eight coastal segments.

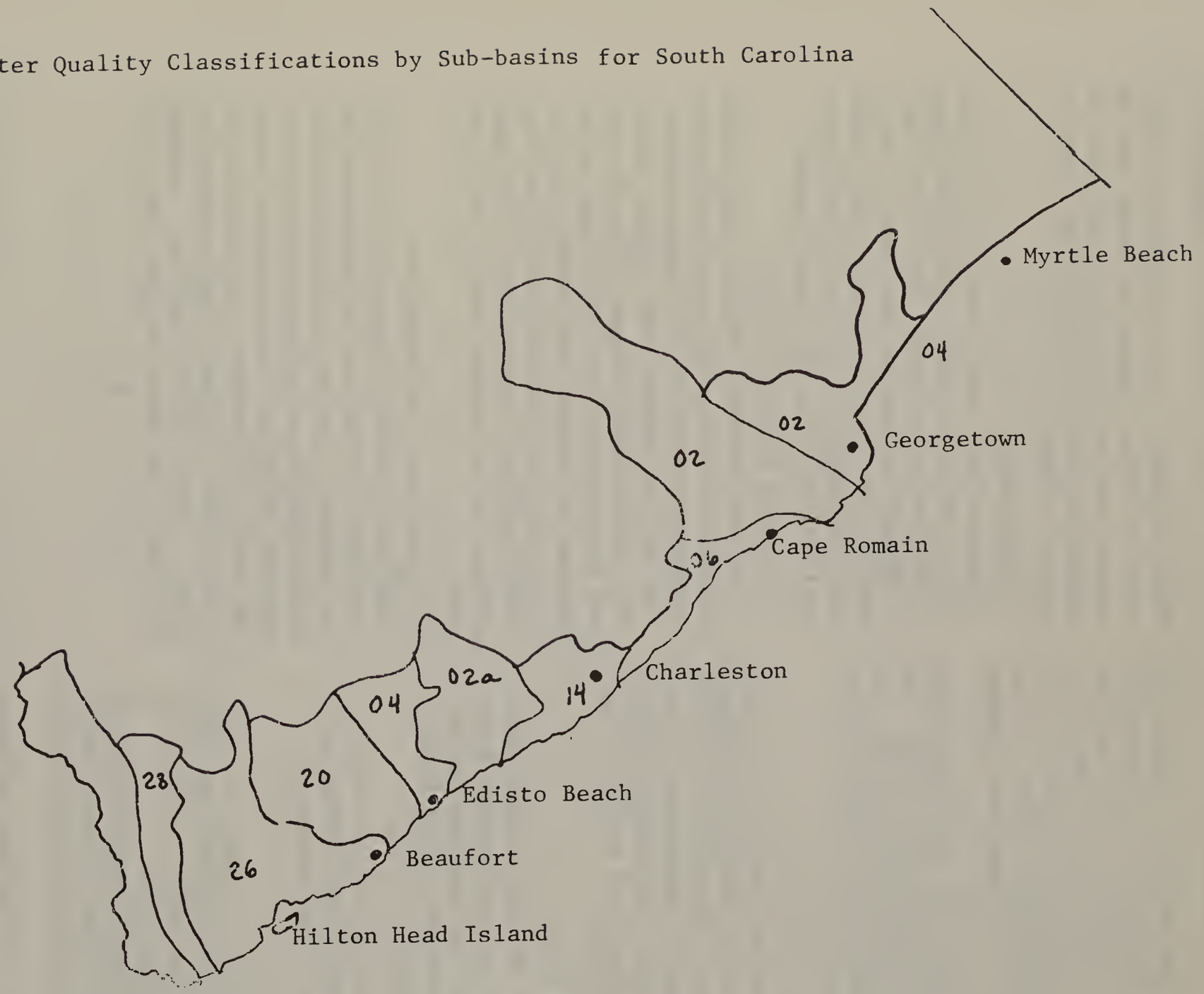
A. NASSAU-ST. MARYS RIVER BASIN

The most frequently observed water quality problems in the Nassau-St. Marys River Basin are high nutrient and low dissolved oxygen concentrations and unacceptable fecal coliform bacteria levels. Natural swamp drainage, diffuse-source runoff from agricultural and urban areas, and the discharge of domestic and industrial waste effluents seem to be the likely causes of the water quality problems. In general this is a small basin with good water conditions except for the Amelia River.

B. FLORIDA EAST COAST RIVER BASIN

The most frequently observed water quality problems in this river basin are high nutrient and low dissolved oxygen levels. High concentrations of phytoplankton and coliform bacteria occur occasionally. Discharge of treated domestic wastes and runoff from developed areas seem to be the primary sources of the water quality problems indicated. There are no significant industrial dischargers in the coastal segments of this basin.

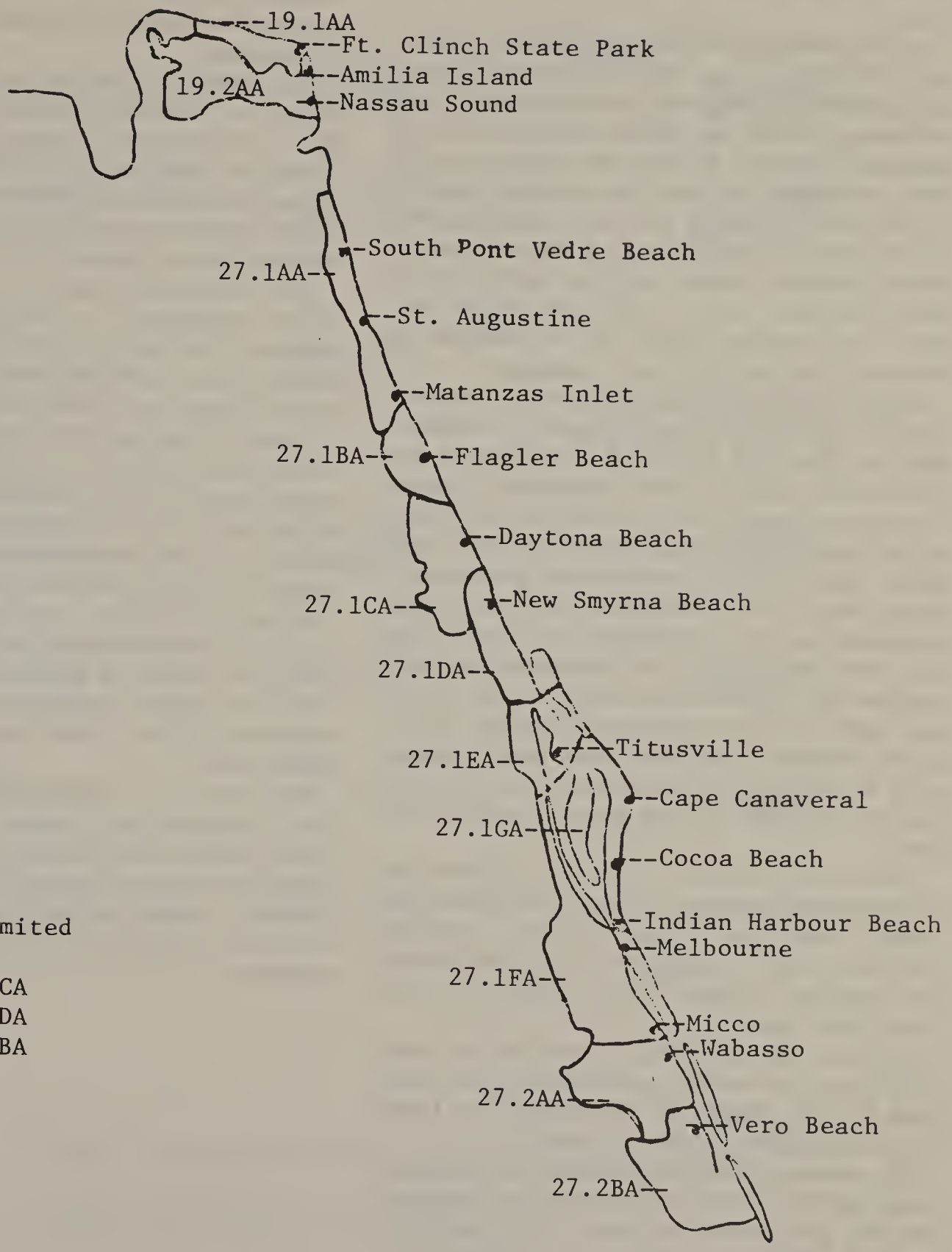
Figure H-3 Water Quality Classifications by Sub-basins for South Carolina



Effluent Limited	Water Quality Limited
02a	02
04	06
20	14
28	26

Source: State of South Carolina. River Basin Water Quality Management Plans. South Carolina Dept. of Health. 1975.

Figure H-4 Water Quality Classification by Segments for Upper Florida East Coast



Water Quality Limited

19.2AA	27.1CA
27.1AA	27.1DA
27.1BA	27.2BA

Effluent Limited

27.2AA

Unclassified

27.1EA
27.1GA
27.1FA

Source: State of Florida. Water Quality Management plans. East coast Florida River Basin and Nassau-St. Mary's River Basin. Dept. of Pollution Control. 1975.

I. Air Quality

The purpose of atmospheric pollution control is to limit the allowed maxima of pollutant concentrations in the atmosphere of an urban or rural area.

In 1971 pursuant the Clean Air Act as amended (42 USC 1857c, *et seq.*) the Environmental Protection Agency promulgated national primary and secondary ambient air quality standards for six pollutants. Within 9 months after promulgation of these standards each state was required to adopt a plan which provided for the implementation, maintenance and enforcement of the national air quality standards within each air quality control region (AQCR). Table I-1 lists the Federal Ambient Air Standards which are as stringent or more stringent than the Federal standards.

Some of the state air quality standards are more stringent than the Federal air quality standards, these are identified in Table I-2. It is noted that Florida has special air quality standards for Dade, Broward and Palm Beach counties, this is evident in the requirements of particulate and SO_2 standards. These counties presently have good air pollution ratings, but violations of both suspended particulate and ozone standards do occur. It has also been indicated that the population of these counties has an increased number of elderly persons with respiratory ailments. Therefore, the air quality standards have been made more stringent so as to minimize the potential adverse effect of lowered air quality on this group of elderly persons.

Pursuant to the Clean Air Act as amended, the Environmental Protection Agency has divided the country into Air Quality Control Regions (AQCR's). There are eight coastal AQCR's within the Southeast Atlantic States. Figure I-1 illustrates these regions.

Estimates of air pollution emissions for each AQCR and for coastal counties have been compiled by EPA Region IV in Atlanta, Ga. These data are compiled in Tables I-3 thru I-7.

The emissions data give quantities of pollutants being emitted into the air, and the air pollution potential gives some indication of the likelihood that the emissions will not be satisfactorily dispersed. However, the data that is presented is not a true picture of the air quality of a given AQCR or county. Most of the data available are from urban centers. This might seem to indicate a region wide problem where in fact it is only an urban problem. Measurements are being initiated in non-urban areas but data has not yet been obtained from these areas.

Figure I-2 gives a general indication of the areas which exceed the national ambient air quality standards.

The influence of particulate and sulfate concentrations on increased mortality has been demonstrated. Over the past 30 years, there has been an increase in death rates due to respiratory and cardiovascular ailments that have been strongly correlated with increased particulate and sulfate air pollution levels (Gottlieb, 1975).

The pollutant produced in the largest volume is carbon monoxide. In 1975 the total carbon monoxide reading for the southeastern coastal AQCR's was 1,399,752 tons/yr. Over 90% of these emissions are due to automobiles.

Table I-8 indicates the counties and the point sources responsible for the highest emissions for particulates, SO_x, NO_x, hydrocarbons and carbon monoxide. It is generally noted that: 1) particulate emissions result from industrial processes such as mineral and wood products, area burning, fugitive dust and paved roads; 2) the SO_x and NO_x result from fuel combustion of coal, oil or natural gas; 3) the use of gasoline for transportation is responsible for carbon monoxide emissions; 4) and hydrocarbons have varied sources for each particular area.

The general air quality in the study area is good. However, the counties with major urban areas indicates high pollution concentrations. It therefore indicates that an increase in pollutants directly correlates with the increase in population of an area. These urban areas seem to be isolated problems.

Table I-1 Federal Ambient Air Quality Standards

Parameter	Standard	
	Primary	Secondary
Particulate Matter:		
Annual geometric mean	75 ug/m^3 [1/]	60 ug/m^3
24-hour maximum	260 ug/m^3	150 ug/m^3
Sulfur Oxides:		
Annual arithmetic mean	80 ug/m^3	
24-hour maximum	365 ug/m^3	
3-hour maximum	--	1300 ug/m^3 (not to be exceed more than once per year)
Carbon Monoxide:		
8-hour maximum	10 mg/m^3 [2/]	10 mg/m^3
1-hour maximum	40 mg/m^3	40 mg/m^3
Photochemical Oxidants:		
1-hour maximum	160 ug/m^3	160 ug/m^3
Hydrocarbons:		
3-hour maximum	160 ug/m^3	160 ug/m^3
Nitrogen Dioxide:		
Annual arithmetic mean	100 ug/m^3	100 ug/m^3

[1/] ug/m^3 = micrograms per cubic meter

[2/] mg/m^3 = milligrams per cubic meter

Source: EPA, 1971.

Table I-2 States that have more stringent air quality standards than federal air quality standards for particualr pollutants.

State	Parameter	Federal Secondary Standards ug/m^3	State Standards ug/m^3	County Standards ug/m^3
North Carolina				
NO_2	annual arithimatic mean	160	same	
	24 hours 1/	none	250	
South Carolina				
photochemical oxidant	1 hour	160	100	
non-methane hydrocarbons	3 hours	160	130	
Georgia				
SO_2	annual arithimatic mean	60	43	
	24 hours	260	229	
	1 hour	none	715	
total oxidant	1 hour	160	98	
non-methane hydrocarbons	3 hours	160	98	
Florida				
SO_2	annual arithimatic mean	80	60	8.6 2/
	24 hours	265	260	28.6
	3 hours 1/	1300	same	57.2
	1 hour	none	same	286
Particulate	annual arithimatic mean	60	same	50
	24 hours	150	same	180

1/ not to be exceeded more than once per year

2/ Dade, Broward & Palm Beach counties, Florida

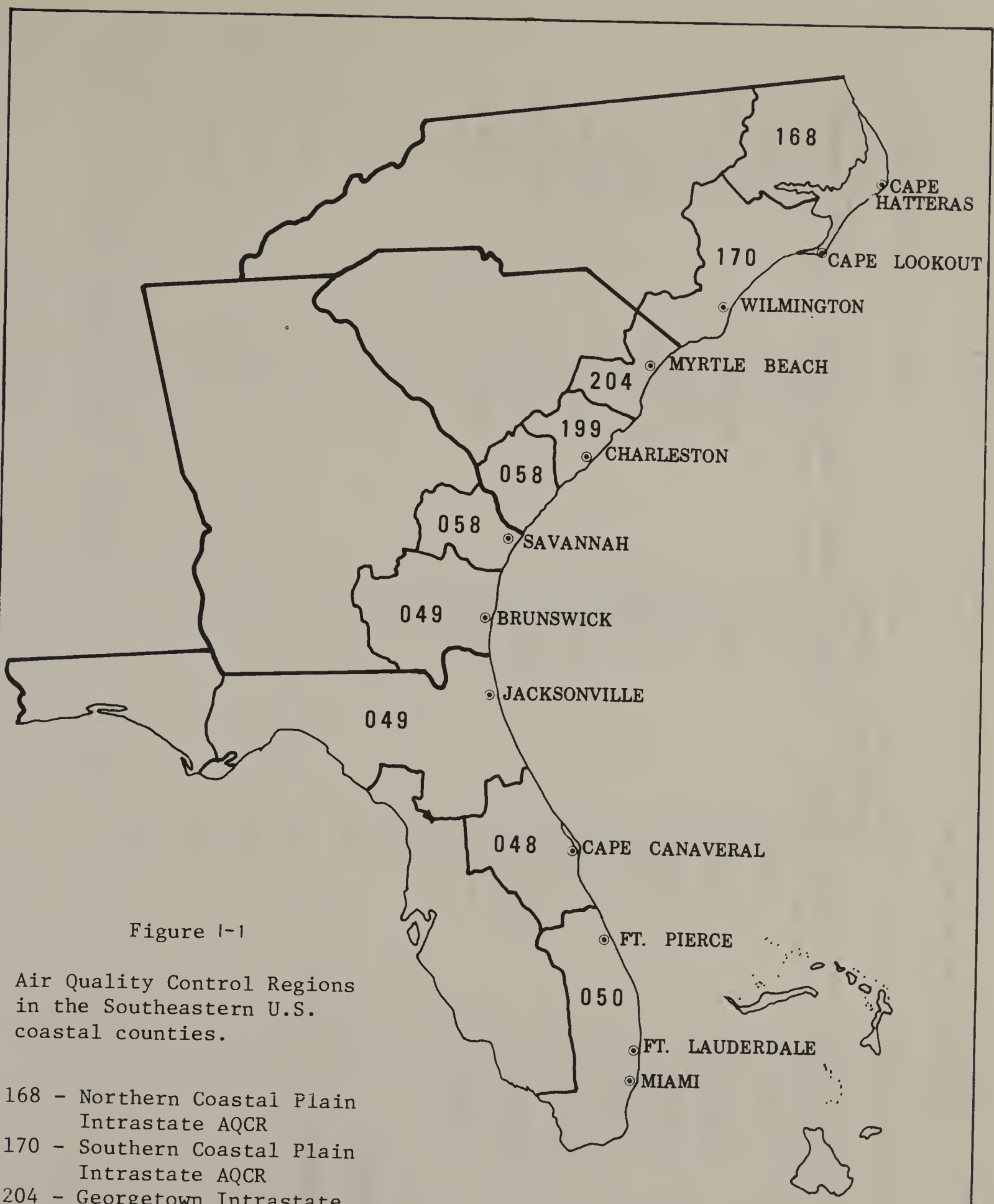


Figure I-1

Air Quality Control Regions in the Southeastern U.S. coastal counties.

168 - Northern Coastal Plain Intrastate AQCR
170 - Southern Coastal Plain Intrastate AQCR
204 - Georgetown Intrastate
199 - Charleston Intrastate
058 - Savannah (Ga.) - Beaufort (S.C.) Intrastate AQCR
049 - Jacksonville (Fla.) - Brunswick (Ga.) Intrastate AQCR
048 - Central Florida Intrastate AQCR
050 - Southeast Florida Intrastate AQCR

Source: Environmental Protection Agency, 1972.

Table I-3 Air Pollution Emissions Estimates for the AQCR of the Southeast Atlantic Coastal Region

AQCR	Emissions in Tons/yr				
	Particulates	Sulfur Oxides	Nitrogen Oxides	Hydrocarbons	Carbon Monoxide
168	24,492	26,495	30,020	41,859	151,615
170	84,626	70,165	69.077	66,588	*324,756
204	12,016	23,725	17,429	24,843	122,858
199	39,450	96,411	47,832	52,164	158,351
058	68,720	52,383	54,120	62,061	247,160
049	*93,987	*212,157	*126,734	*77,914	307,619
048	14,529	49,977	69,614	29,018	87,393

* Highest recording

Source: EPA Region IV Data Bank, 1974.

Table I-4 Air Pollution Emissions Estimates for North Carolina Atlantic Coastal Region

	Emissions in Tons/yr				
County	Particulates	Sulfur Oxides	Nitrogen Oxides	Hydrocarbons	Carbon Monoxide
Beaufort	2,781	9,602	3,417	3,429	15,721
Berte	3,418	268	1,580	2,409	11,511
Brunswick	2,915	2,066	5,320	5,442	20,812
Camden	440	130	927	1,073	4,102
Cartert	1,100	960	3,734	4,586	18,179
Chowan	325	520	589	1,177	5,051
Craven	3.071	5,107	5,720	6,281	34,562
Currituck	490	337	2,434	1,672	5,685
Date	201	249	1,321	2,549	8,922
Hyde	1,010	403	2,982	3,027	9,367
New Hanover	*13,377	25,728	16,033	10,836	27,534
Onslow	5,162	921	6,541	*11,267	*55,050
Pamlico	367	325	2,229	1,538	5,208
Pasquotank	5,454	568	1,144	1,682	7,070
Pender	1,220	349	2,628	3,280	13,035
Perquimans	309	102	523	958	4,542
Tyrrell	3,037	*67,157	*44,008	2,097	6,280
Washington	1,202	149	832	1,825	7,458

Source: EPA Region IV Data Bank, 1975.

Table I-5 Air Pollution Emissions Estimates for the South Carolina Atlantic Coastal Region

County	Emissions in Tons/yr				
	Particulates	Sulfur Oxides	Nitrogen Oxides	Hydrocarbons	Carbon Monoxide
Beaufort	1,191	489	2,518	5,515	21,393
Charleston	*11,306	*21,962	*17,531	*39,524	*112,192
Colleton	5,156	15,925	13,984	4,146	18,119
Georgetown	6,365	14,793	4,389	8,644	63,703
Horry	3,865	8,531	10,908	11,409	39,953
Jasper	675	56	734	2,574	7,427

Source: EPA Region IV Data Bank, 1974.

Table I-6 Air Pollution Emissions Estimates for the Georgia Atlantic Coastal Region

County	Emissions in Tons/yr				
	Particulates	Sulfur Oxides	Nitrogen Oxides	Hydrocarbons	Carbon Monoxide
Bryan	132	91	1,086	1,330	5,769
Camden	1,705	14,049	3,804	2,648	24,258
Chatam	*48,444	*32,842	*23,118	12,308	*108,197
Glynn	7,462	19,337	9,504	5,555	34,809
Liberty	11,278	2,263	6,073	*22,608	41,960
McIntosh	139	83	1,129	2,175	8,904

Source: EPA Region IV Data Bank, 1974.

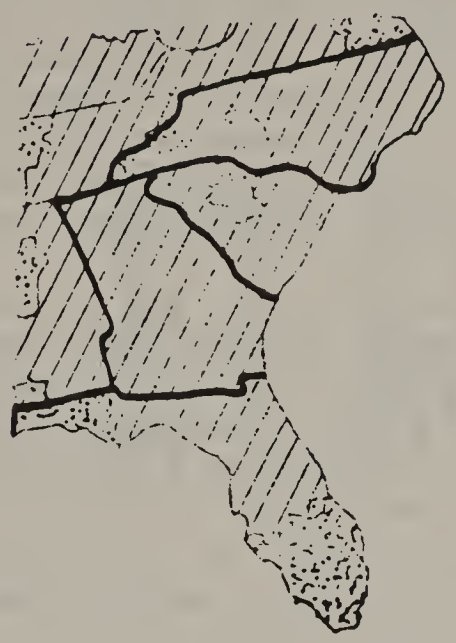
Table I-7 Air Pollution Emissions Estimates for the Florida Atlantic Coastal Region

County	Emissions in Tons/yr				
	Particulates	Sulfur Oxides	Nitrogen Oxides	Hydrocarbons	Carbon Monoxide
Brevard	1,887	13,950	19,882	6,619	18,105
Broward	6,204	38,994	42,473	20,089	36,510
Dade	3,388	10,906	21,705	*34,803	*67,864
Duval	*21,607	*110,593	*58,593	19,097	41,792
Flagler	1,149	36	290	1,215	4,204
Indian River	1,469	9,274	4,818	2,164	6,877
Martin	3,731	19,610	7,891	2,338	6,726
Nassau	4,013	15,546	4,774	2,441	8,299
Palm Beach	6,683	24,706	21,367	9,487	24,390
St. John's	1,150	98	667	2,019	6,699
St. Lucie	1,518	143	959	2,591	8,219
Volusia	4,900	33,562	38,247	6,593	19,385

Source: EPA Region Data Bank, 1974.

Figure I-2 Southeastern United States Regions That Exceed National Ambient Air Quality Standards

Status of oxidant/ozone levels, 1973.



ANNUAL OR 24-hour STANDARD EXCEEDED
ALL REPORTED DATA ARE BELOW STANDARDS
NO DATA

Status of sulfur dioxide levels, 1973.



1-hour STANDARD EXCEEDED
ALL REPORTED DATA BELOW 1-hour STANDARD
NO DATA

Status of suspended particulate levels, 1973.



PRIMARY STANDARD EXCEEDED (24-hour OR ANNUAL)
ALL REPORTED DATA ARE BELOW PRIMARY STANDARD
NO DATA

Status of carbon monoxide levels, 1973.



8-hour STANDARD EXCEEDED
ALL REPORTED DATA BELOW THE 8-hour STANDARD
NO DATA

Source: Monitoring and Air Quality Trends Report, 1973. U.S. Environmental Protection Agency. Office of Air and Waste Management. Research Triangle Park, N. Carolina. EPA-450/1-74-007.194

Table I-8. Point Source Emissions for Selected Southeastern U.S. Coastal States and Counties.

State	County	Emission	Source	Point Source
North Carolina	New Hanover (Wilminton)	particulate	industrial proc.	mineral prod.
		hydrocarbons	miscellanous	forest fire
	Onslow	SO_x and NO_x	fuel comb.	agri. burning
	Tyrell	CO	solid waste disposal	elec. gen.
	Onslow			gituminous coal
				incineration
				wood ind.
S. Carolina	Charleston (Charleston)	particulate	industrial proc.	mineral & wood prod.
		SO_x	fuel comb.	residual oil
		NO_x and CO	transportation	gasoline
		HC	industrial prod.	evaporation
Georgia	Chatham (Savannah)	particulate	industrial proc.	wood prod.
		SO_x and NO_x	fuel comb. (indus-	residual oil, gas
		CO	trial)	& wood
	Liberty	HC	indus. prod. &	wood & gasoline
			trans.	military aircraft
			transportation	
Florida	Dade	HC & CO	transportation	gasoline
	Duval (Jacksonville)	particulate	industrial proc.	mineral prod.
		SO_x and NO_x	fuel combustion	residual oil

Source: EPA Region IV Data Bank, 1975

J. Historical and Projected Economic Growth

1. Introduction

The report of the Commission on the Future of the South to the Southern Growth Policies Board (1975) included consideration of the four areas of growth management, land and natural resources, human resources and transportation. As a result of the energy crisis and inflation, the scope of the Commission's work expanded to include these topics.

The report of the Commission included a 15 state region within its area of consideration, extending from Maryland to Texas, and provided some general comments concerning the factors that led to the growth of the South.

During the 1950's the region made its transition from an agricultural and mining economy to a manufacturing economy. During the 1960's the South's own internal markets and urban centers developed sufficiently to provide, for the first time, more jobs for those engaged in making goods, mining, or raising food and fiber. Also, it was during this period that Southern financial institutions achieved the ability to finance growth from the region's own capital resources, a dramatic breakthrough from the previous need to seek development capital outside the region.

The massive outmigration of southern population, particularly Appalachian and black, that occurred during earlier decades is rapidly tapering off, and the South is becoming an area of net inmigration although this trend is highly concentrated and many sections of the South are still exporting large numbers of their people.

The Commission's report noted certain growth related characteristics of the South, including: 1) the South is heavily dependent upon the automobile, 2) the South's pattern of growth is energy intensive, 3) the South has become an urban society, and 4) several Southern cities are becoming major U.S. and world centers.

The report made mention of some of the problems associated with the growth of the South. Among these problems were:

1) Much recent growth has not yielded commensurate benefits to the people of the South.

2) The South has been preoccupied until recently with the quantity of its economic growth rather than its quality.

3) The growth of the South has been very unevenly distributed.

4) Urban areas are growing without regard for the wise use of land or the orderly provision of public services and access.

5) Simultaneously, the more isolated non-urban areas of the South, heavily depopulated by the migration of the past, suffer from depleted tax resources, inadequate public services and housing, and insufficient economic opportunities.

6) Where growth has occurred it has been allowed, in many instances, to erode the region's prized natural assets.

The Report to the Southern Growth Policies Board contained numerous recommendations in many areas of concern; including the need for a growth policy, human resource development, land use and natural resources, human resources, and transportation. The Commission hoped that the report and the extensive research and committee findings generated for the Commission would be widely used. It was hoped that the major portions would furnish subjects for conferences and seminars concerned with the impacts of growth on government, local communities, private enterprise and the Southern people generally.

Figure J-1 reproduced from this report illustrates the major employment trends in a area comprising the 15 Southern states and Missouri.

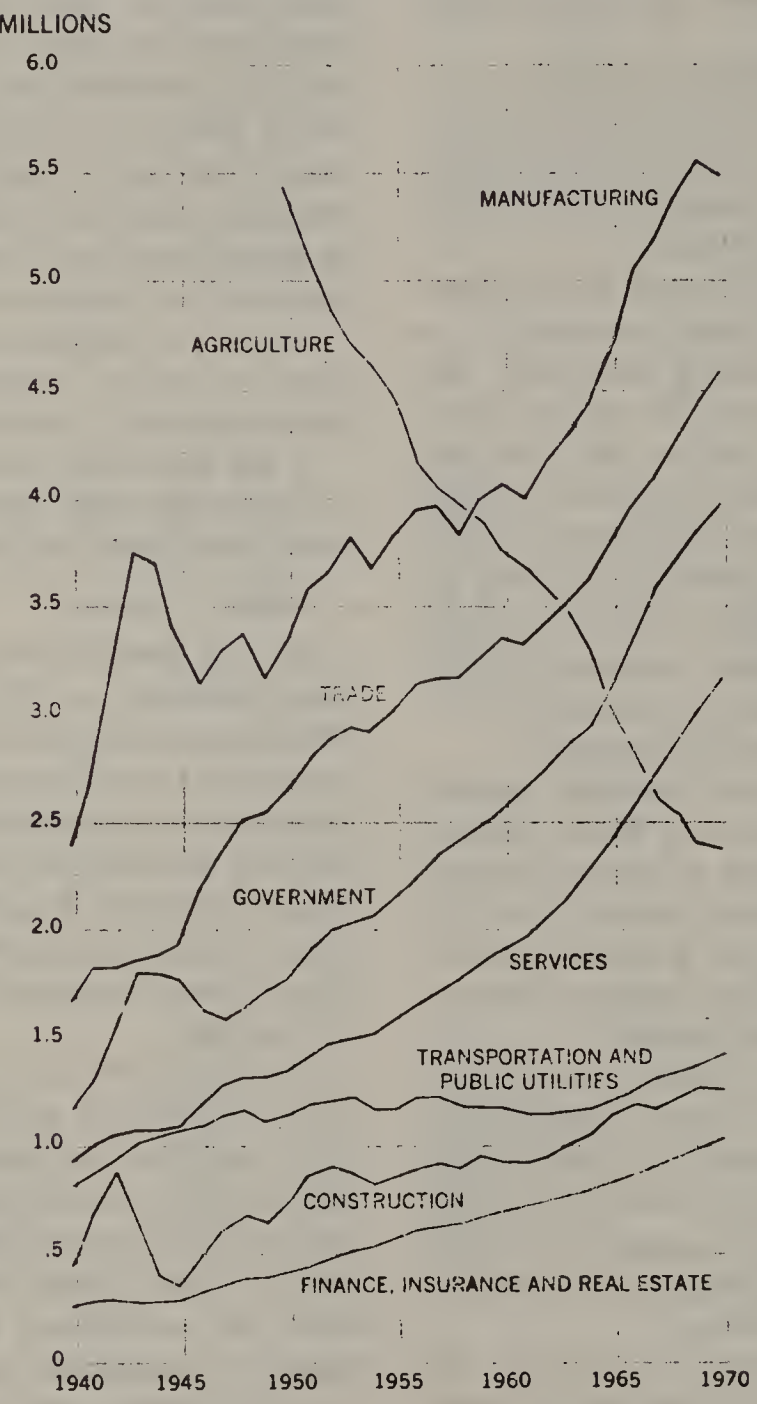
In the following section, comments applicable to individual states and regions have been obtained from other refernece material.

a. North Carolina

The past trends in the North Carolina economy were reviewed in the publication, Economic Development Strategy, Phase 1, North Carolina's Economic Growth Management Study, prepared for the North Carolina Department of Administration and the North Carolina Department of Natural and Economic Resources by the Research Triangle Institute and published during July 1974. The following passages were obtained from this publication:

"Between 1950 and 1960, population grew by 12.2% in spite of a continuing out-migration of large numbers of people. The transition from agriculture to manufacturing, which had begun as early as 1880, was accelerated during the decade; this shift was fueled principally by white males from the agricultural sector. The Employment Security Commission estimates that employment in manufacturing grew by 105,000 and, by 1960, the manufacturing sector represented 31.2% of total employment and the agricultural sector only 13.4%. However, these manufacturing jobs were improvements over alternative forms of employment and permitted the State's per capita personal income growth to keep pace with the growth in the national average, throughout the decade."

FIGURE J-1 EMPLOYMENT TRENDS IN THE 16-STATE SOUTH[1] BY SELECTED MAJOR INDUSTRIES, 1940-1970



1 Includes 15 Southern states and Missouri.

Source: Ross W. Hammond, **Economic Development Trends in the 16-State South**, Industrial Development Division, Georgia Institute of Technology, March 1972.

"The North Carolina economy made significant gains in the 1960-1970 decade in employing higher percentages of its working age population, in stemming out-migration, and in closing the per capita income gap between North Carolina and the nation. Although the relative standing of manufacturing wages remained 49th among the States, per capital personal income, which rose from 70.4% of the national average in 1960 to 81.6% in 1970, continued up to 84.5% in 1972. There was a substantial increase in the number of workers entering the labor force, particularly white and non-white females. The major share of the manufacturing employment growth continued to be in relatively low wage jobs, for the latter part of the decade showed a trend toward higher wage employment. This trend has continued into 1974."

The report commented on the growth characteristics of the Coastal Plain regional division, incorporating an area larger than the four coastal planning regions, in the following passage:

"Generally, Coastal Plain counties other than those in the northeast began moving into an intermediate stage of development over the decade. They experienced manufacturing employment growth rates that exceeded the State average; however, total employment rates in those counties were below the State average. More recent evidence of Coastal Plains growth after 1970 seems to indicate that this region is completing its movement out of the initial stage of development and into the intermediate stage (with dependence on manufacturing replacing dependence on agriculture)."

The Statewide Development Policy, a publication of the Department of Administration of the State of North Carolina in March 1972, commented on the changes that had taken place in the economy of the state:

"Today, the whole of the rural southeast is in the midst of a remarkable economic transformation, one without historical parallel. This is the unyielding movement from a rural farm to a rural non-farm way of life.

"For the past quarter century, the spotlight has been on the spectacular urban growth of the south-resulting in the emergence of major metropolitan centers.

"Now, agriculture is universally and rapidly declining as a major source of rural job opportunities and farm population along with it. Although economic activity in rural population centers has expanded it has not been sufficient to fully replace agriculture. Population has been flowing into these centers. But their growing importance as a source of non-farm job opportunities has not been recognized, nor has the need for an urban service base to support these centers as an alternative to metropolitan concentration."

The coastal area of North Carolina has been included in four multi-county planning regions designated regions O, P, Q and R (Figure J-2).

The planning agencies for the various regions are identified in the following summation.

Region O (Cape Fear Council of Governments): consists of the four counties of Brunswick, Columbus, New Hanover and Pender. This region is located on the southern portion of the North Carolina coast adjacent to South Carolina.

During 1970, the population of this planning region amounted to 172,305, and the 1970 per capita income amounted to $2,894, compared to the state per capita income of $3,218. Cash receipts from farm marketing amounted to approximately $57 million during 1971. During 1971, approximately 5.4% of the workforce was unemployed, compare to 3.9% unemployed on a statewide basis.

Region P (Neuse River Council of Governments): consists of the nine counties occupying the central portion of the coastal area of North Carolina, including Greens, Wayne, Duplin, Lenoir, Onslow, Jones, Craven, Pamlico and Carteret.

During 1970, the population of this planning region amounted to 410,123 persons, and the per capita income of $3,218. Cash receipts from farm marketing amounted to approximately $225 millions of dollars during 1971. During 1971, approximately 5.1% of the workforce were unemployed, compared to a state unemployment rate of 3.9%.

Region Q (Mid-East Economic Development Commission): this planning region consists of five counties located between the common border with the State of Virginia and Pamlico Sound, and since the region is located inland of planning area R, it is not adjacent to the Atlantic Ocean. During 1970, the population of Planning Region Q amounted to 178,667 persons, and the per capita income was $2,598, compared to a state per capita income of $3,218. Cash receipts from farm marketing amounted to approximately $129 millions of dollars in 1971, and, during that year 5.6% of the workers were unemployed, compared to a state figure of 3.9% unemployed.

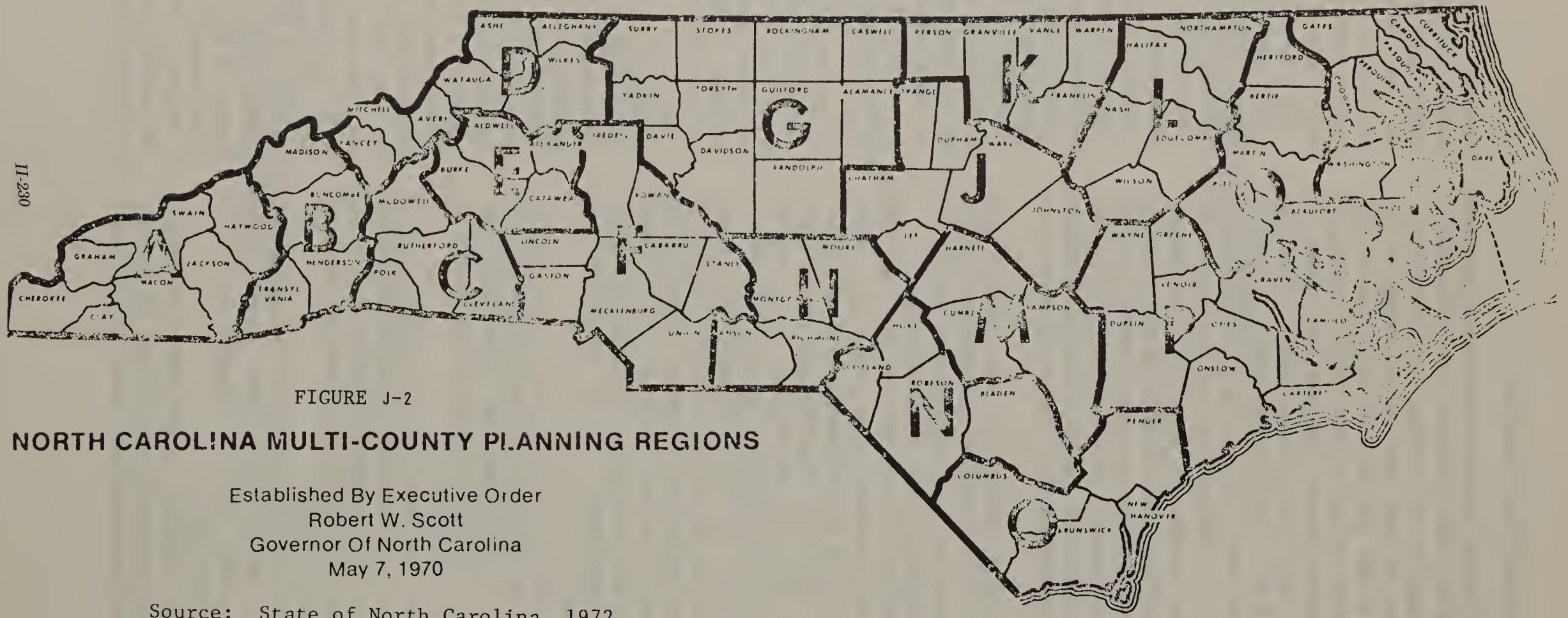


FIGURE J-2

NORTH CAROLINA MULTI-COUNTY PLANNING REGIONS

Established By Executive Order
Robert W. Scott
Governor Of North Carolina
May 7, 1970

Source: State of North Carolina, 1972

Region R (Albemarle Regional Planning and Development Commission): this 10 county planning region is located in the northeastern portion of North Carolina, adjacent to the Atlantic Ocean and the Boundary of the State of Virginia. It is composed of the counties of Currituck, Camden, Pasquotank, Perquimans, Gates, Chowan, Washington, Tyrrell, Dare and Hyde. During 1970, the population of the planning region amounted to 97,302, and the per capita income amounted to $2,305 compared to a state per capita income of $3,218. Cash receipts from farm marketing amounted to approximately 5.7 x 10^7 dollars during 1971, and during 1971, unemployment was 6.3%, compared to a statewide unemployment of 3.9%.

The changes in population between the years 1940 and 1970 (Table J-1) show an overall pattern of growth, with Region P exhibiting a rate of growth greater than the rest of the coastal region, and greater than even the rate of growth in the state population. However, the growth rates have fluctuated as reflected in Table J-2.

The State of North Carolina has been divided into eight crop reporting districts. The districts incorporating the coastal zone are the Northern, Central and Southern Coastal districts. The counties included within these districts include all of the counties included within the four planning regions, and some additional inland counties are included within the crop reporting districts that are included in other planning districts. Therefore, the following statistics incorporate a larger area than statistics relating to the planning regions.

The Coastal Plains comprise about two-thirds of the State's harvested cropland but only an eighth of its pastureland (Table J-3). Thus the flat fields, easily-tilled and loamy soils in the eastern third of the State support the principal acreages of row crops especially corn, tobacco, soybeans, peanuts and cotton while the fertile pastures on the rolling topography of the Piedmont and Mountain regions nurture most of the States' dairy and beef cattle enterprises. (State of North Carolina, 1975d).

The changes in employment that have taken place within the activities of agriculture, forestry, fishing and mining during this decade 1960-1970 have been summarized in The North Carolina Economy (1974).

In the four state planning regions O, P, Q and R the percentage of employment within these categories declined, in spite of an increase in total employment (Table J-4).

Additional tabular data contained within "The North Carolina Economy." (State of North Carolina, 1974) identify the following trends. In the four state planning regions, the total number of commercial farms declined during the decade 1959-1969. The percentage of farms with sales over $20,000 increased, but the percentage of commercial farms with sales below $5,000 decreased very markedly in each of the four planning regions. Cash farm receipts, however, increased in each of the planning areas during the decade 1959-1969.

The percentage of total farm operators included in the category of tenancy declined in each of the planning districts, and the off-farm employment of farm operators was summarized in tables indicating a substantial increase in the percentage of farm operators working 100 or more days off the farm. Comparison of the percentage of operators so engaged in 1959, indicated that a substantially higher percentage of the farm operators were engaged in working 100 or more days off the farm in the latter year.

Within the coastal planning regions during the period 1958-67, the number of manufacturing establishments, number of employees, and amount of payroll generally increased in regions O, R and Q, but declined in region R, adjacent to the Virginia border (Tables 5 and 6).

Similar increases and comparisons were made for the categories of wholesale and retail trade and selected service industries (Table 7).

The following passages were based on some of the data presented in the North Carolina Data File (State of North Carolina 1975b).

During the year 1974, the total volume of export sales exceeded $1.4 billion. During the year 1973 the state's agricultural exports totalled $526 million, leading the southeastern region. Manufactured exports showed an increase from $739 million in 1969 to $930 million in 1972. During 1972, North Carolina exported more than $337 million dollars worth of tobacco and $143 million dollars worth of machinery.

Approximately 64% of the state's exports are manufactured goods and 34% are agricultural products. Major exports include tobacco, tobacco products, machinery, chemicals, soybeans, feed grains, electrical equipment, food products, and paper and allied products.

In order to accommodate increasing trade activity, the North Carolina State Port Authority is

Table J-1. Population Trends in North Carolina from 1940 - 1970.

Region	Population 1940	Population 1970	Change	Percent Change
Region O	128,433	172,305	+43,872	34.15
Region P	245,979	410,123	+164,144	66.73
Region Q	169,339	178,667	+9,328	5.50
Region R	95,902	97,302	+1,400	1.45
Total 4 Regions	639,653	858,397	218,744	34.19
State Total	3,571,623	5,082,059	1,510,436	42.28

Source: State of North Carolina, 1972.

Table J-2. Percent Change in Population for North Carolina from 1940-1970.

Planning Region	Percent Change 1940-50	1950-60	1960-70
Region O	18.0	5.2	8.0
Region P	23.7	27.4	5.8
Region Q	4.4	1.9	-0.8
Region R	1.7	0.1	-0.4

Source: State of North Carolina, 1972.

Table J-3. Land Use in North Carolina.

	North	Central	South	Total Acreage
Total Land in tracts (acres)[1/]	3,845,313	3,197,397	4,514,677	11,557,387
Non-Farm Land	1,218,672	811,055	1,444,856	3,474,583
Farm Land:				
Harvested Cropland	978,953	951,538	967,160	2,897,651
Idle Cropland	81,884	112,501	202,698	397,083
Open Pasture	74,863	66,312	99,994	241,169
All Other[2/]	1,490,941	1,255,991	1,799,969	4,546,901
Total Form Land	2,626,641	2,386,342	3,069,821	8,082,804

Note: Data not complete for some districts.

[1/]Total land in tracts of ten or more acres.

[2/]Other uses include homesites, woods, waste, etc.

Source: State of North Carolina, 1975d.

Table J-4. Employment Trends in North Carolina.

Planning Region	Total Employment 1970	Percentage (1970) Agr. Forest Fishing & Mining	Manufac-turing	Trade	Services	Other
O	63,651	7.9	26.2	19.1	30.1	16.7
P	120,446	11.3	19.9	20.0	35.7	13.1
Q	63,162	14.8	22.7	20.1	30.4	12.0
R	32,776	11.1	23.8	18.9	32.5	13.7

Planning Region	Total Employment 1970	Percentage Change (1960-70) Arg. Forest Fishing & Mining	Manufac-turing	Trade	Services	Other
O	20.6	-51.1	65.3	26.9	38.6	18.2
P	21.3	-45.4	87.3	30.0	44.6	18.5
Q	12.3	-46.7	59.9	28.1	41.1	23.0
R	6.6	-48.3	19.7	21.6	29.8	14.7

Source: State of North Carolina, 1974.

Table J-5. Manufacturing, Employment and Payroll Statistics for North Carolina, 1958-1967.

Manufacturing (1967)

Planning Region	Number of Establishments	Number of Employees	Payroll $ million
O	271	12,500	60.4
P	415	18,400	85.4
Q	271	11,900	49.8
R	149	2,700	11.0
Total	1,106	45,500	$206.6

Source: State of North Carolina

Table J-6. Selected Employment Statistics for North Carolina, 1972.

Labor Force (1972)

Planning Region O	Total	Manufac.	Non-Manufac.	Public Admin.	Agri.	Other
Brunswick	9,830	2,560	5,050	1,280	820	2,060
Columbus	19,290	5,200	4,870	1,930	4,810	2,370
New Hanover	36,740	10,160	19,160	5,010	450	5,590
Pender	6,730	610	1,120	880	1,610	880
Total	72,590	18,530	30,200	9,100	7,690	10,900

Planning Region P	Total	Manufac.	Non-Manufac.	Public Admin.	Agri.	Other
Cartevet	11,880	1,580	4,410	1,370	310	2,380
Craven	19,950	3,440	7,420	7,640	1,810	2,580
Duplin	16,340	4,210	2,990	1,700	4,520	2,360
Greene	6,940	760	560	650	2,180	690
Jones	3,360	210	370	390	1,130	510
Lenior	23,370	7,830	8,360	3,870	3,010	3,220
Onslow	20,090	1,580	8,590	7,300	1,060	2,040
Pamlico	3,250	450	470	350	530	410
Wayne	30,130	6,200	11,760	6,800	3,870	5,110
Total	135,310	26,260	44,930	30,070	18,420	19,300

Table J-6 (continued)

Planning Region Q	Total	Manufac.	Non-Manufac.	Public Admin.	Agri.	Other
Beaufort	15,560	4,310	5,440	1,600	2,230	2,570
Bertie	6,480	1,510	990	980	2,270	940
Hertford	9,490	2,440	3,570	1,130	1,420	1,270
Martin	10,830	4,310	2,870	1,280	2,530	1,620
Pitt	31,560	5,720	9,750	5,930	5,240	4,880
Total	73,920	18,290	22,620	10,920	13,690	11,280

Planning Region R	Total	Manufac.	Non-Manufac.	Public Admin.	Agri.	Other
Camden	1,820	30	130	180	370	210
Chowan	4,090	1,070	1,630	500	750	750
Currituck	2,610	120	370	290	400	250
Dare	3,380	60	1,950	450	20	1,060
Gates	2,270	220	340	380	730	310
Hyde	1,810	140	360	260	500	280
Pasquotank	10,120	1,690	3,690	2,620	670	1,520
Perquimans	2,800	330	550	410	710	480
Tyrrell	1,390	220	270	180	260	160
Washington	4,500	380	940	720	530	530
Total	35,290	4,260	10,230	5,990	4,940	5,550

NOTE: Totals do not add due to adjustment for multiple job holdings and commuters etc.

Source: State of North Carolina, 1974.
Growth and change in some of the economic factors are summarized in Table J-7. (State of North Carolina, 1974).

Table J-7. Business and Employment Statistics for North Carolina, 1958-1967.

Manufacturing Establishments

	Number of Establishments (1967)	Percent Change 1958-67	No. of Employees 1967 (thousands)
Region O	271	16.3	12.5
Region P	415	22.8	18.4
Region Q	271	9.7	11.9
Region R	149	-12.9	2.7
Total 4 Regions	1,106		45.5
State	8,266	13.4	643.8

Wholesale Trade Establishments

	Number of Establishments	Percent Change 1958-67	No of Employees 1967
Region O	256	12.3	2,565
Region P	432	6.4	3,823
Region Q	263	9.1	2,305
Region R	146	0.7	959
Total 4 Regions	1,097		9,652
State	7,010	22.1	76,625

Retail Trade Establishments

	Number of Establishments	Percent Change 1958-67	No. of Employees 1967
Region O	1,822	12.0	6,060
Region P	3,561	13.0	13,599
Region Q	1,994	7.1	6.982
Region R	1,030	-1.3	3,138
Total 4 Regions	8,407		29,779
State	45,447	10.1	196,412

Table J-7 (continued)

	Selected Service Establishments		
	Number of Establishments	Percent Change 1958-67	No. of Employees 1967
Region O	959	34.7	1,950
Region P	1,792	48.6	3,473
Region Q	851	47.0	1,384
Region R	594	43.1	866
Total 4 Regions	4,196		7,673
State	26,827	45.6	65,209

Source: State of North Carolina, 1974.

continuously expanding and improving its facilities. The Port Authority operates two major ports at Wilmington and Morehead City. Capital expenditures for expansion of facilities at Wilmington and Morehead City in 1974 and 1975 totals $15 million.

B. SOUTH CAROLINA

The coastal portion of South Carolina consists of 10 counties included within three regional councils of government (Figure J-3).

The Waccamaw Regional Council of Governments consists of the three northerly counties of Georgetown, Horry and Williamsburg, located adjacent to the North Carolina state boundary.

The Berkeley-Charleston-Dorchester Regional Planning Council incorporates the three counties in the central coastal area of the state centered on the port city of Charleston including Berkeley, Charleston and Dorchester counties.

The third area, including Beaufort, Colleton, Hampton, and Jasper counties, is known as the Lowcounty Regional Planning Council.

South Carolina may be divided into three regions: The Piedmont, Midlands and the Coastal Region. The Piedmont occupying approximately the northwestern third of the state, the Midlands the central third of the state, and the Coastal region the area adjacent to the Atlantic Ocean.

The Piedmont has 38.7% of the state's population and contains 23,722 km² (9,159 mi²), or 30.3% of the state's area.

The Midlands has 38.9% of the state's population, and 32,914 km² (12,708 mi²), or 42% of the area of the state.

The Coastal Region has 22.4% of the state's population and contains 21,647 km² (8,358 mi²).

The South Carolina Development Plan, prepared for fiscal years 1974/1975 (South Carolina, 1975) commented on the changes that have been taking place in the South Carolina economy in the past. The following discussion has been obtained from this publication.

During the last decade, South Carolina has experienced remarkable economic progress. In the 1960's , total personal income increased 142%, from $3.1 billion in 1960. Per capita personal income showed a gain of 105% over the same period, from $1,334 to $2,737. This momentum has carried over into the 1970's. By the third quarter of 1973, total personal income for South Carolina had reached $10.5 billion.

The decline in agricultural employment has been of major importance to South Carolina's economic development. Though agricultural employment has declined, income generated from agriculture has grown steadily and therefore agriculture is, and will remain, an important sector in the state's economic structure. South Carolina had a consistently low unemployment rate in comparison to the national average. This indicates that as agricultural employment has declined, it has been absorbed elsewhere in the economy. Much of this former agricultural employment has shifted into manufacturing and other non-agricultural employment such as contract construction, services, wholesale, and retail trade, etc. This shift has allowed South Carolina to develop a more diversified economic structure. The employment pattern of the 1960's has begun to shift. In 1974, manufacturing was 36.6% of total wage and salary employment as compared with 40.7% in 1960, and 40.4% in 1970. The sectors showing the largest growth in wage and salary employment are contract construction, services, and government, particularly at the state and local levels.

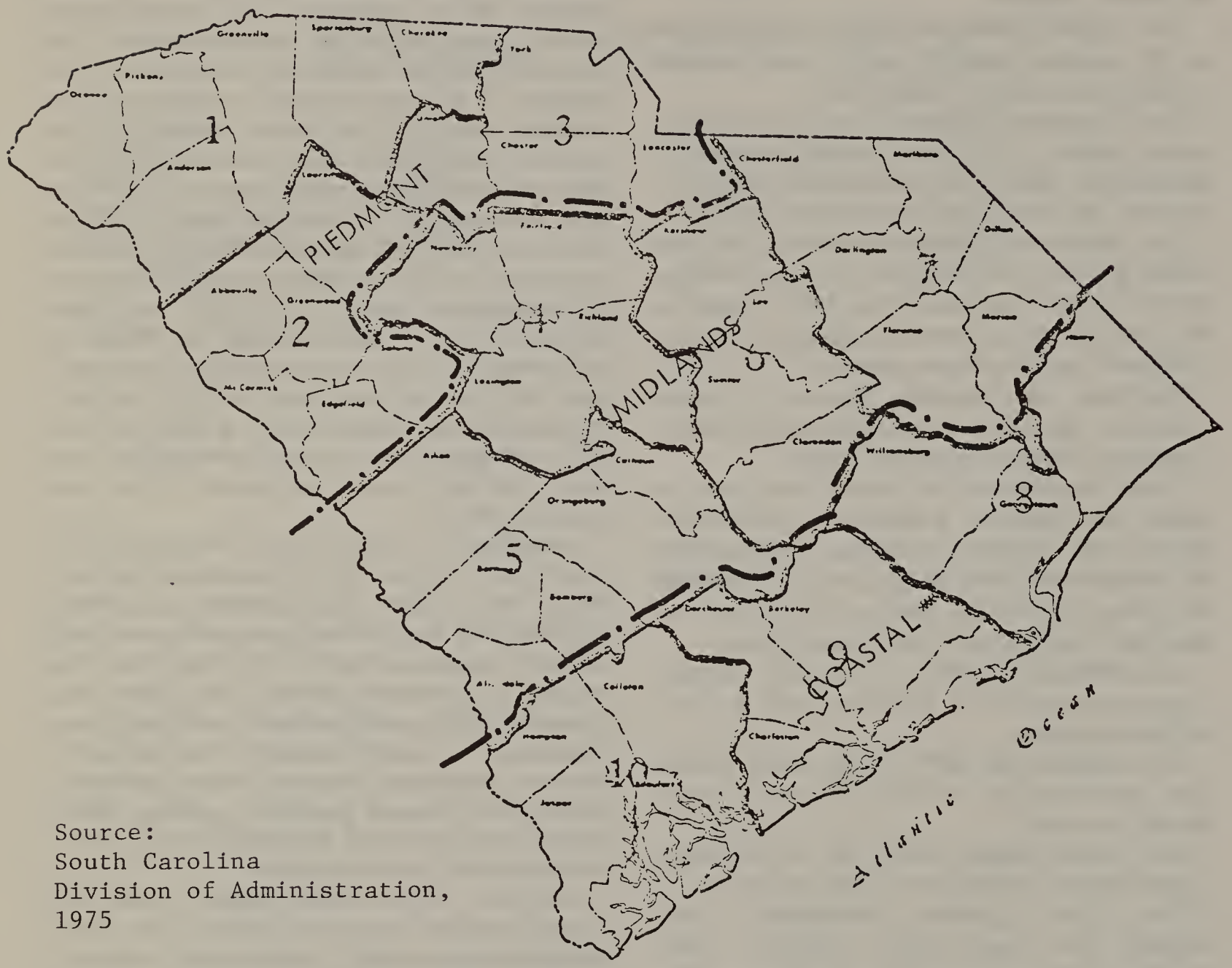
Agriculture in many parts of the state traditionally has not been only an economic endeavor but a way of life. The traditional agricultural products have been tobacco and cotton, and until recently, almost one fourth of the labor force was engaged in agricultural pursuits. This activity was characterized by small inefficient farms and a preponderance of readily available, low-skill labor. Recently introduced products such as soybeans, poultry and livestock products, peaches, watermelons, specialty crops and forest products have required lesser amounts of labor.

Until the 1960's, textile apparel, wood and lumber products were dominant in the state's manufacturing activities. More recently, however, a slow diversification has begun and now paper products, electronic components, transportation equipment, chemical products, synthetics and other more sophisticated products are manufactured in the state. However, the industries which dominate the manufacturing scene are those which rank below average in the areas of employment growth and wage.

Some comments on economic and industrial conditions applicable primarily to the coastal zone were obtained from the South Carolina Development Plan (South Carolina Division of Administration, 1975).

THE STATE OF SOUTH CAROLINA REGIONS AND DISTRICTS

FIGURE J-3



Source:
South Carolina
Division of Administration,
1975

*** Coastal is not the same as the federally-designated Coastal Plains Region which encompasses all of the Coastal and Midlands except Fairfield and Newberry Counties.

1 S. C. Appalachian Council of Governments
2 Upper Savannah Regional Planning & Development Council
3 Catawba Regional Planning Council
4 Central Midlands Regional Planning Council
5 Lower Savannah Regional Planning & Development Council
6 Santee-Wateree Regional Planning Council
7 Pee Dee Regional Planning & Development Council
8 Waccamaw Regional Planning & Development Council
9 Berkeley-Charleston-Dorchester Regional Planning Council
10 Lowcountry Regional Planning Council

The state's principal seaport is Charleston which has the largest containerization handling facilities in the U.S. Georgetown and Port Royal provide the state with two other deep-water ports.

During 1974, a record of 3.17 million tons of cargo was moved across state docks, with 2.3 million tons handled in Charleston alone. The majority of the port users are located in the Piedmont section of the state, and a large proportion of the tonnage coming through South Carolina ports is associated with other states as far away as Tennessee, Ohio, Wisconsin and Illinois. The South Carolina Port Authority was created with the broad purpose of facilitating and increasing the cargo handled at South Carolina's ports for the economic benefit of all the citizens of the State. Because both Georgetown and Port Royal harbors are severely restricted by project depth 8 m, (27 ft.) and 7 m (24 ft.) respectively, and because trade in those ports is closely tied to the local industry, all future expansion in port facilities is planned for the Charleston harbor area.

The military and military-related establishments in the state make a substantial contribution to the economy. It is evident that military establishments are a dominant factor in several sub-areas. Charleston and Beaufort, in particular, rely on civilian-military related employment. A major shift in the allocation of the nation's output from military to civilian uses will have significant effects on these areas which depend heavily on military contracts for high levels of employment unless continuing efforts are made to accommodate the transition.

South Carolina provides a year-round variety of both man-made and natural tourist attractions including beaches, historic cities, flower gardens and fishing. In 1974, there were more than 28 million out-of-state visitors traveling to or through South Carolina. This is an increase of 27% over 1973 figures. The Grand Strand (Myrtle Beach area) receives the largest share of the state's annual volume of non-resident visitors with about 30%. Charleston is next with 17% of the non-resident visitors. The Beaufort (Hilton Head Island) area and the Santee-Cooper area are also rapidly becoming destination areas for tourist and outdoor recreation.

The Coast Region of South Carolina has 301 km (187 mi.) of shoreline 80 km (50 mi.) of which is the "Grand Strand" (dominated by Myrtle Beach) with more than 13,000 hotel and motel rooms and almost 8,000 campsites. By far the state's most significant tourist attraction, South Carolina beaches, are among the best in the world and offer opportunities for nearly every form of saltwater recreation from sailing to swimming. The four coastal state parks; Myrtle Beach, Huntington, Edisto and Hunting Island account for the attendance in the state park system.

The state has 3,074 km (2,876 mi) of tidal shoreline and 182,115 ha (450,000 acres) of tidal streams and sounds available for sport fishing, and over 16,090 km^2 (10,000 mi) of offshore water area is also accessible. It is estimated that at least $15 million is spent each year by anglers on saltwater sport fishing in South Carolina.

As a result of hearings relating to proposed Sale 43, additional information has been received from South Carolina, and is quoted below.

"The coastal region of the Southeast has been designated by Congress as an economically deprived area. In 1966 the Coastal Plains Regional Commission, created through a 1965 act of Congress, consisted of North Carolina, South Carolina and Georgia. In 1975 Florida and Virginia were added. The purpose of the Congressional action was to provide a vehicle through which it could channel special funds to encourage economic development in this lower income area.

"Income levels of the region are still well below the national average. The South Carolina area of the region has a per capita income of only $4,215 as compared to the national average of $6,460. At present South Carolina's per capita income ranks 48th among the 50 states. It is therefore imperative that every reasonable measure be taken to ensure that the people of our state have an opportunity to achieve economic parity with the rest of the nation. We believe that the activities related to oil and gas exploration on the East Coast will have a positive economic impact and contribute to a better standard of living for our people.

"We estimate 25,000 to 30,000 new jobs will be needed annually in South Carolina to eventually achieve a 4% unemployment level. The Coastal Plains area of the state alone needs more than 16,000 jobs each year to accomodate those entering the work force for the first time, those who lose their jobs for a number of reasons, and to lower our unemployment to a respectable level. The impact of offshore exploration and related activities could contribute significantly to fulfulling this need. The beneficial effects would be

far greater if commercial production became a reality.''

c. GEORGIA

The following description of the economy of the coastal region of Georgia was based primarily on the publication Overall Economic Development Program for Coastal Georgia (First Stage) published in 1970 by the Coastal Area Planning and Development Commission located in Brunswick, Georgia. The areas included within the Coastal Area Planning Commission includes the counties of Camden, Glynn, McIntosh, Long, Liberty and Bryan; and thus includes the entire coastal area of Georgia except for Chatham County, located in the northern portion of Georgia coast adjacent to South Carolina.

During the early 1900's the timber industry, based on the availability of virgin forest, gave way to the paper pulp and naval stores industry, based on reforestation. During this period, Brunswick became established as the distribution and transportation center of the area.

Following World War II, an economic slump resulted from the deactivation of government facilities and the closing of the shipyards in Brunswick. By the 1950's, paper production was the dominant economic factor. Small industries, and tourism became increasingly important.

The economy of the area in the last 50 years has not changed as drastically as the changes that have taken place in other areas of the south. This has been due, in part, to the fact that the area had not been a strong agricultural area for the past 50 years. However, some areas of the economy have experienced a surge causing a need, and the resulting influx, of labor from the more agriculturally oriented areas in the interior. Such industries as tourism, seafood and light industry, and the expansion of pulp and paper, and naval stores have been noted as industries requiring increased amounts of labor.

Agriculture plays a relatively minor role in the area's economy, with crop products assuming moderate significance in only Bryan, Long and Liberty counties. Camden County, while devoid of other agri-enterprise, need be mentioned because of its tobacco production.

Only 590 persons out of an area labor force of over 31,000 were employed in agriculture, and this low employment level may be due to several factors including relatively unproductive agricultural soils and the more productive alternative use of land for timber production. Also, the production of beef is making gains within the area although a basic problem of grain supply is holding back this endeavor.

The importance of the timber industry in the area may be judged by the following statements.

''The coastal area contains approximately 785,563 ha (1,941,100 acres) of land. Of this area 557,029 ha (1,376,400 acres) or 70.9% of the total area is contained in commercial forest land. Longleaf, loblolly and yellow pine are the most prevelant species of trees grown in the area.'' (Georgia Coastal Area Planning and Development Commission, 1970).

Studies by the Bureau of Business and Economic Research at the University of Georgia show that in 1966 over ten million vacation-recreation trips, involving more than thirty million travelers, were taken by private automobiles on Georgia highways. U.S. 17 traversing the entire length of the coastal area is a major tourist route from the eastern seaboard to Florida. Over five million people a year travel this route, and it has been estimated that with the completion of Interstate 95 this number should almost double. The majority of visitors and pass-through travelers through the area are from the East Coast and other parts of Georgia. Jekyll Island, a state owned park, Brunswick and the St. Simons area are destination points in the region.

The Coastal Area Planning and Development Commission published the Areawide Economic Base and Population Study in April, 1975. The area included in this report was expanded to include all of the Atlantic coastal counties and two counties located inland adjacent to the coastal counties. This study incorporated projections of population and employment as well as brief descriptions of the economy of the individual counties.

The eight county area included an areal expanse of 9,777 km^2 (3,775 mi^2) and was entirely located within the Coastal Plain physiographic region (Figure J-4). The total population amounted to 298,700 in 1973. The region is located between two Standard Metropolitan Statistical Areas (SMSA), Savannah, Ga. and Jacksonville, Fla., and is served by Interstate Highway I-95 which traverses the area. The principal transportation hub is Savannah with rail, air and port facilities.

LOCATION OF PLANNING AREA

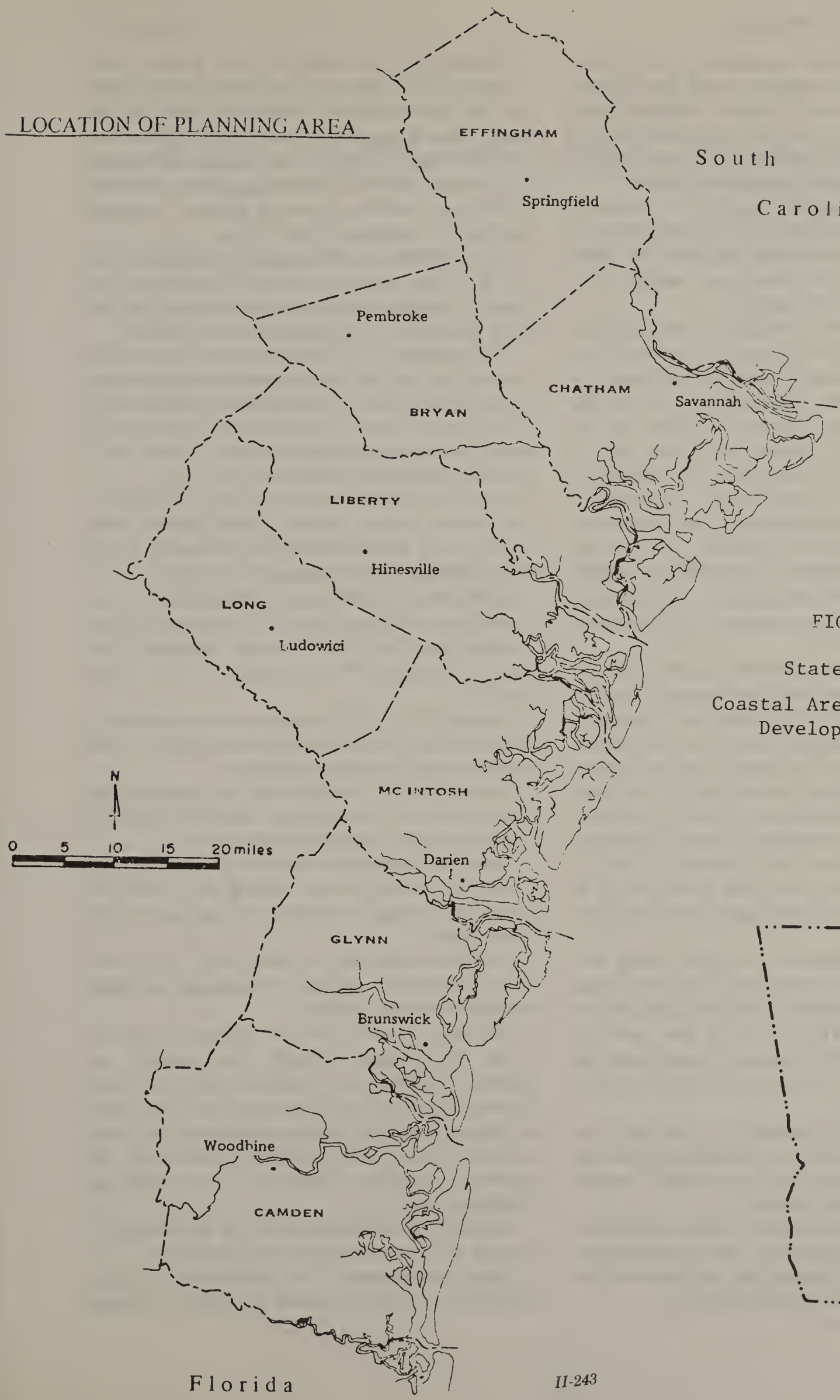


FIGURE J-4

State of Georgia

Coastal Area Planning and Development Commission, 1975.



The South Georgia agriculture and timber economy has an even impact on the entire length of the coastal area. Coastal fisheries exist throughout the area, and the area's undeveloped resources, economic problems and other factors appear to be consistent throughout the area.

The economic base of the city of Savannah may be described as diversified and includes such activities as the production of pulp and paper products, fertilizer manufacturing, tourism, food processing and the port activity.

The second largest city in the area is Brunswick, located in Glynn County. The principal activities in the Brunswick area include forest related industries, pulp and chemical processing, and tourism. Resort activity is based on the presence of ocean beaches, golf and sites of historical interest. The Port of Brunswick, operated by the Georgia Ports Authority, is equipped to handle general cargo. One notable export from this port was gypsum, used in the manufacture of wallboard. Hinesville, in Liberty County, inland from the coast, is experiencing growth related to the activation of Fort Stewart as a training base.

Among the economic problems identified by the Coastal Area Planning and Development Commission as characteristic of the area are a declining agricultural base, highway and barge transportation to the hinterland, declining fisheries, a lack of recreational facilities (other than in the Brunswick area), a lack of employment for unskilled workers, lack of knowledge of, and exploration for mineral resources, and increasing cost of governmental services and rising taxes caused by increased service demands upon local and state governments.

The income distribution in the eight county area was developed from census data and presented as both family median income and per capita income for the year 1970 (Table J-8). The per capita income figures provide a means of comparing the region and the state with the national income figure for that year.

Although continued farming is expected to be carried on in the region, it is anticipated that the farms will be of larger size and probably employ fewer workers than in the past.

Forest lands with commercial value make up an estimated 74.1% of the region, and forest management practices have insured that the pulpwood industry will not run out of raw materials.

Textiles play an important role in half of the counties in the region. It is a major Georgia industry, but has not made significant inroads on the coast. Food processing is a major activity in those counties where access to the fishing and shrimping grounds is best. Chemical products produced in the area meet the needs of regional industries and provide supplies to other areas.

Manufacturing in the coastal area accounted for 23.1% of the employment in 1970, and employment in manufacturing was projected to increase from 25,870 in 1975 to 32,490 in the year 1990.

The following brief descriptions of the economies within the individual counties were obtained from Coastal Area Planning and Development Commission (1975). The counties are discussed in order commencing with the northern coastal counties and proceeding southwards.

Chatham County includes the city of Savannah, the regional center for the coastal planning area, with a trade area extending to Brunswick to the south and into South Carolina on the north.

Agricultural activity has declined almost to insignificance while residential, commercial and industrial land uses have become dominant. Employment during 1970 amounted to 65,851 persons.

During 1970, 12,763 persons were employed in manufacturing establishments producing wood, food, chemical and other products.

During 1974, 3.3 million tons of freight passed through the port, and shipping can be classified as a major industry employing 500 persons.

Retail and wholesale commercial establishments employed 16,000 persons during 1972, and the total sales volume amounted to more than a billion dollars.

Tourism is a major business within the county due to the historic interest of Savannah and other locations of scenic beauty.

Effingham County, located northwest, and adjacent to Chatham County, has recently experienced growth as residents move in from Chatham County. The development is anticipated to spread from the southern portion of the county, in response to an anticipated increase in the number of residents commuting into neighboring Chatham County.

The trend of gradual reduction in the amount of acreage in farm land is expected to continue.

Total employment in Effingham County amounted to 4,368 persons in 1970, of which

Table J-8. Per Capita Income for Selected Georgia Counties, 1970.

Area	Per Capita Income (1970)
Bryan County	$1,891
Camden County	2,228
Chathem County	2,671
Effingham County	2,163
Glynn County	2,566
Liberty County	2,010
Lang County	1,630
McIntosh County	1,729
Regional	$2,520
Georgia	2,649
National	3,945

Source: Coastal Area Planning and Development Commission, 1975.

1,732 were employed in manufacturing wood products, transportation equipment and textiles. Approximately 440 persons were engaged in construction activity.

Bryan County, located south and west of Chatham County, has been changing from a rural, farming oriented community to a suburban community to the expanding Savannah metropolitan area. Fort Stewart divides the county into two parts, and an anticipated build up in the presonnel employed at Fort Stewart may be expected to add to the development pressures within the county.

The major basic business activities such as wood products and tourism can be expected to remain the same, but some relocation will probably result from the growth of Fort Stewart as well as additional highway facilities.

During 1970, 2089 persons were employed at various occupations within the county. Manufacturing, retail sales and construction accounted for more than half of the employment.

Liberty County is the third largest county in the coastal group as measured by population.

Liberty County's 3,770 employed persons were distributed with broad diversity among many industries. There are few manufacturing industries located within the county, the largest of which was a paper company with 355 employees. Textiles was another major activity, in 1974 there were over 400 people employed by two firms, but during early 1975, one was shut down due to the economic situation of the nation. Employment in retail and wholesale trade, and in the service industries, is expected to increase due to the build up in Fort Stewart.

McIntosh County, located approximately in a central position along the Georgia coast, has, in the past, been a rural, farming, fishing, and forest oriented community. Development pressure from Glynn County on the south can be expected to continue. Major business activities have evolved around the fishing and food processing industries, a plant producing foot-wear and other rubber products, and forest products. McIntosh County's 2,363 employed persons were employed predominantly in manufacturing (35.5%), retail trade (14.6%), agricultural (9.7%) and construction (9.2%). During 1970, manufacturing employment was 839, more than half of which commuted to nearby Glenn County. Food processing, especially seafood, is expected to continue to thrive as well as the related fishing industry.

Glynn County, including the port city of Brunswick, has been the second most populus county in the coastal region for many years. Industrial expansion is expected to take place along the waterfront and on Colonel's Island, while commercial establishments are expected to consolidate themselves in Brunswick and along the strip leading to the Brunswick mall. Major business activities in the county consist of pulp and paper, retail and wholesale trade, tourism and food processing. St. Simons and Jekyll Islands will continue their roles as resort residential areas.

Glynn County's 17,841 employed persons were engaged primarily in manufacturing, services and retail sales during 1970, and the employment pattern is expected to remain about the same, although an increase in government employment might result from the location of the Federal Law Enforcement Training Center.

During 1974, Glynn County had 51 manufacturing firms, and during 1970, 4,656 people were employed in manufacturing chemicals, food products, textiles, metals, wood products, and other products. Five of the fifteen largest industrial employers in coastal Georgia are located in Glynn County and are engaged in food processing, paper, chemicals, and fabricated metal (CZM, 1976). Total employment in manufacturing in Glynn County was estimated to increase from 5,150 in 1975 to 6,030 in the year 1990. Other employment results from the tourist activity based on resort areas and marshlands, the increased traffic along I-95, and shipping activity in Brunswick. As Brunswick becomes a central city, the employment in retail and wholesale trade can be expected to increase from the 1972 level of 4,000 workers, and a similar increase may occur in the service industry.

Camden County is the most southerly coastal county in Georgia. During 1970, 4,206 persons were employed, over 70% in manufacturing, retail sales and the service industries. Agricultural employment is expected to remain at close to existing levels until development pressures force the farmer to sell off land.

Camden County has very few manufacturing industries within its borders. In 1970, the majority of the 2,004 workers employed in manufacturing were either involved with the paper industry or the manufacture of chemical goods.

Tourism, although not presently a major business activity, is expected to receive a tremendous

boost with the opening of Cumberland Island. With the National Seashore as a destination, tourism should improve.

D. FLORIDA

State Planning District No. 4 is located in the northeastern portion of the State of Florida, adjacent to the Atlantic Ocean and the common state boundary with Georgia. The district includes the counties of Baker, Clay, Duval, Flagler, Nassau, Putnam and Saint Johns (Figure J-5). The principal population center in the region is the city and Standard Metropolitan Statistical Area of Jacksonville.

State Planning District No. 6 is located in the east central portion of the state, adjacent to the Atlantic Ocean, and adjoining District No. 4. District No. 6 includes the counties of Brevard, Lake, Indian River, Orange, Osceola, Seminole, and Volusia (Figure J-5).

The population of the counties within these planning districts was published by the Bureau of Economic and Business Research (1975) in the Florida Statistical Abstract (Table J-9). The projected population figures shown are those published in the Statistical Abstract. The agencies shown are the designated regional planning agencies for the multi-county planning districts (Figure J-5).

During the years from 1945 to 1969, the number of farms in Florida decreased from 61,159 to 35,586. During the year 1945, approximately 5.3 x 10^6 ha (13.1 million acres) were included in farms. The acres of land in farms increased to 6.2 x 10^6 ha (15.4 million acres) in 1964 and decreased to 5.7 x 10^6 ha (14.0 million acres) in 1969. During 1969, approximately 1.5 x 10^6 ha (3.8 million acres) were classified as cropland, 0.9 x 10^6 ha (2.2 million acres) as harvested cropland, and 0.4 x 10^6 ha (1 million acres) used as pasture. During 1969, approximately 1.5 x 10^6 ha (3 million acres) were classified as woodland, and 2.6 x 10^6 ha (6.4 million acres) as "all other land". During the period 1945-1969, increases have occurred in the amount of harvested cropland, in cropland used for grazing, and in "all other land". The acreage classified as woodland has decreased. During this time, there has been a decrease in the number of farms with less than 81 ha (200 acres) harvested, and an increase in the number of farms with more than 81 ha (200 acres).

During 1969, the number of farms, and the land in farms as a percent of the total land area for the counties included in State Planning Regions 4 and 6, is shown on Table J-10.

Farm marketings in Florida during the year amounted to approximately $1.9 billion, approximately $1.3 billion from crops and approximately $600 million from livestock and products. The principal commodities produced included oranges, cattle, milk and grapefruit. During the 1973-74 crop year, all citrus production in Florida amounted to approximately 228 million boxes. Approximately 77 million boxes were produced in the counties included in Planning District 6. According to statistics published by the research department of the Federal Reserve Bank of Atlanta, farm employment in Florida increased from 105,000 in 1951 to 131,000 in 1958, and declined from that peak to approximately 114,000 in 1972.

During the year 1975, tree farms containing 2.5 x 10^6 ha (6.3 million acres) were located in Florida. The wholesale manufactured value of forest products in Florida amounted to more than $859 million. The most important forest product was pulpwood valued at $695 million, but the value of lumber amounted to approximately $93 million, and other products included naval stores, veneer, poles and pilings, fuel wood, and such miscellaneous items as fence posts, charcoal wood and rustic products.

Table J-11 lists the quantity and value of landings of fish in Florida and adjacent states and was obtained from the Florida Statistical Abstract and incorporates data published by the National Marine Fisheries Service.

During 1974, the principal species of fish, measured by value, landed in Florida included: shrimp, spiny lobster, red snapper, black mullet and king mackerel.

The total number of commercial fishermen employed in Florida during 1974 was 11,950, 9,850 full time and 2,100 part time. The total number of fishery products plants in Florida in 1974 was 18; two produced canned fishery products, three industrial fishery products, and 13 produced fish fillets and steaks.

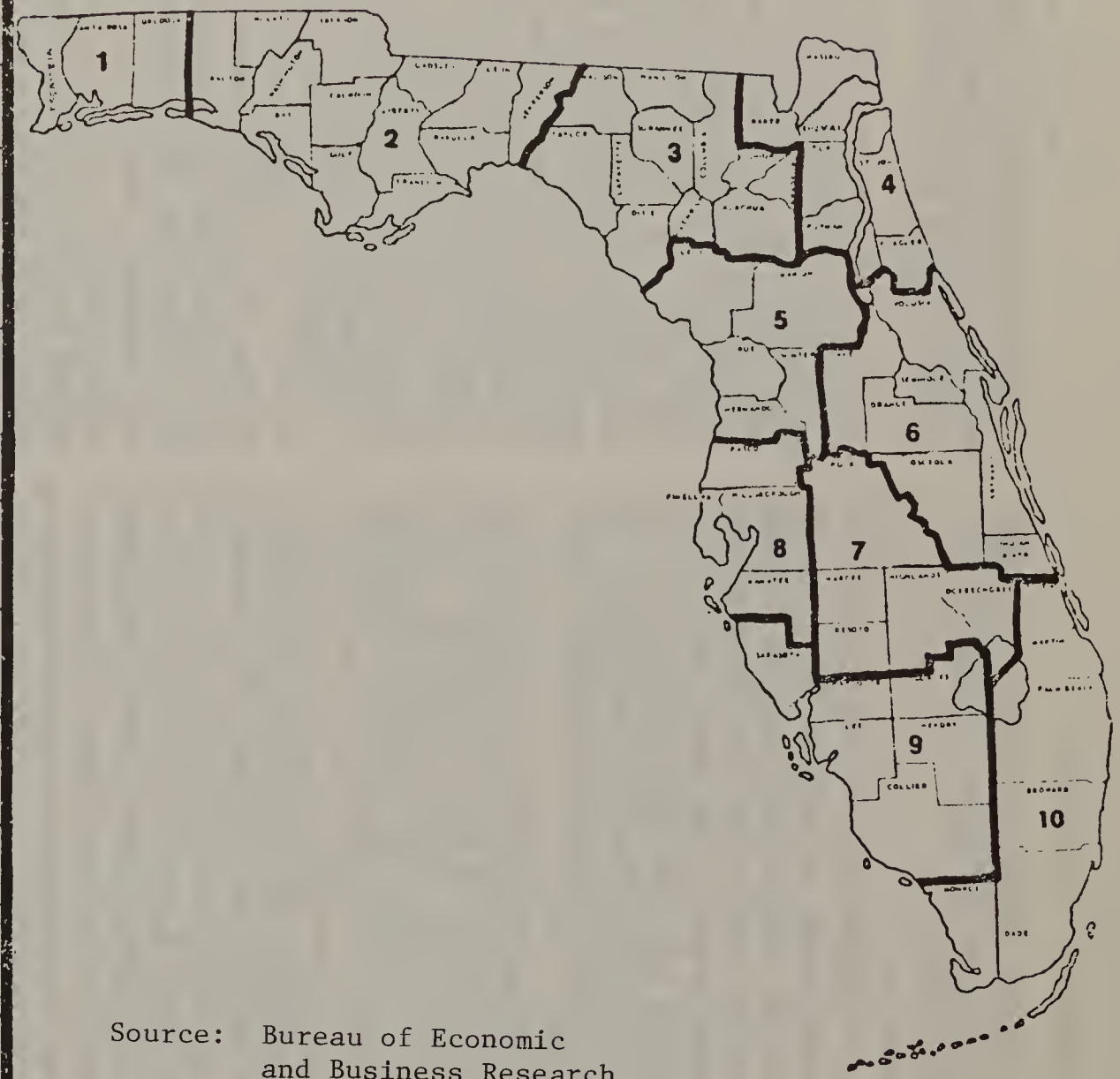
The Division of Economic Development of the Florida Department of Commerce includes 17 counties in the Northeast Florida region, and therefore, this region includes a larger areal extent than the counties included within the State Planning Region. Florida Trend, a publication of

REGIONAL PLANNING AGENCIES DESIGNATED UNDER CHAPTER 380, FLORIDA STATUTES

(effective date July 1, 1974)

FIGURE J-5

Regional Planning Agency	Multi-County Planning District	Counties	Regional Planning Agency Director Mailing Address & Telephone Number
West Florida Regional Planning Council	1	Escambia Okaloosa Santa Rosa	Mr. Daniel F. Krumel, Exec. Dir. P. O. Box 486, Pensacola 32502 (904) 434-1027
Northwest Florida Planning and Advisory Council	2	Bay, Calhoun, Franklin, Gadsden, Gulf, Holmes, Jackson, Jefferson, Leon, Liberty, Wakulla, Walton, Washington	Mr. Barry A. Boswell, Exec. Dir. 5321 B - West Highway 98 Panama City 32401 (904) 785-9581
North Central Florida Regional Planning Council	3	Alachua, Bradford, Columbia, Dixie, Gilchrist, Hamilton, Lafayette, Madison, Suwannee, Taylor, Union	Mr. Charles F. Justice, Exec. Dir. No. 5 Southwest Second Place Gainesville 32601 (904) 376-3344
Jacksonville Area Planning Board	4	Baker, Clay, Duval, Flagler, Nassau, Putnam, St. Johns	Mr. Edward D. Baker, Exec. Dir. Room 401, Courthouse Jacksonville 32202 (904) 633-2690
Withlacoochee Regional Planning Council	5	Citrus, Hernando, Levy, Marion, Sumter	Mr. Jackson E. Sullivan, Exec. Dir. 3500 N. E. Silver Springs Blvd. Ocala, Florida 32670 (904) 629-8921
East Central Florida Regional Planning Council	6	Brevard, Indian River, Lake, Orange, Osceola, Seminole, Volusia	Mr. Clifford Guillet, Exec. Dir. 1011 Wymore Road Winter Park 32789 (305) 645-3339
Central Florida Regional Planning Council	7	DeSoto, Hardee, Highlands, Okeechobee, Polk	Mr. Jim Duane, Exec. Dir. P. O. Box 2089, Bartow 33830 (813) 533-4146
Tampa Bay Regional Planning Council	8	Hillsborough Manatee Pasco Pinellas	Mr. Scott Wilson, Exec. Dir. 3151 Third Avenue North St. Petersburg 33713 (813) 821-2811
Southwest Florida Regional Planning Council	9	Charlotte, Collier, Glades, Hendry, Lee, Sarasota	Mr. Roland Eastwood, Exec. Dir. 2121 W. 1st St., Ft. Myers 33902 (813) 334-7382
South Florida Regional Planning Council	10	Broward, Dade, Martin, Monroe, Palm Bch., St. Lucie	Mr. Barry Peterson, Exec. Dir. Ste. 429, 1515 NW 167 St. Miami 33169 (305) 621-5871



Source: Bureau of Economic and Business Research, 1975

Table J-9. Population Trends in Selected Florida Counties

District 4 - Jacksonville Area Planning Board

County	Population (Thousands) 1970	1985	Change	Percent Change
Baker	9.2	18.0	8.8	95.6
Clay	32.1	72.5	40.4	125.9
Duval	528.9	665.3	136.4	25.8
Flagler	4.5	12.0	7.5	166.7
Nassau	20.6	45.1	24.5	118.9
Putnam	36.4	52.5	16.1	44.2
St. Johns	31.0	51.6	20.6	66.5
District	662.7	917.0	254.3	38.4

District 6 - East Central Florida Regional Planning Council

County	Population (Thousands) 1970	1985	Change	Percent Change
Brevard	230.0	302.7	72.7	31.6
Indian River	36.0	69.0	33.0	91.7
Lake	69.3	111.7	42.4	61.2
Orange	344.3	555.7	211.4	61.4
Osceola	25.3	54.9	29.6	117.0
Seminole	83.7	218.6	134.0	161.2
Volusia	169.5	293.1	123.6	72.9
District	958.1	1,605.7	647.6	67.6

Source: Bureau of Economic and Business Research, 1975.

Table J-10. Trends in Farm Land for Selected Florida Counties

Region 4

County	Number of Farms	Farm Lands Percent of Total Land
Baker	180	20.9
Clay	189	41.1
Duval	320	15.2
Flagler	79	29.4
Nassau	221	15.7
Putnam	462	55.8
St. Johns	219	17.0
District	1,670	

Region 6

County	Number of Farms	Farm Lands Percent of Total Land
Brevard	473	35.3
Indian River	425	58.5
Lake	1,634	56.3
Orange	1,224	42.4
Osceola	416	104.3
Seminole	510	34.5
Volusia	895	32.8
District	5,577	

Source: Bureau of Economic and Business Research, 1974.

Note: An excess of farm acreage over land area occurs because a farm's entire acreage is counted at its headquarters, and part may lie in another county.

Table J-11. Fish Landed - Quantity and Value of Landings 1974

State	Pounds (1,000)	Value ($1,000)
Florida	171,394	$66,367
Alabama	36,962	17,087
Georgia	18,157	7,094
Louisiana	1,228,906	86,694
Mississippi	304,794	16,355
North Carolina	206,683	17,544
South Carolina	18,402	6,861
Texas	97,203	72,455

Note: Landings for interior waters are estimated.

Source: Bureau of Economic and Business Research, 1974.

Trend Publications, Inc. of Tampa, Florida reviewed the economy of the northeast region of Florida in the issue dated April, 1975. Marion County was not included in the Northeast Florida region in Florida Trend's article. The following comments have been obtained from this source.

The dominant feature of the Northeast region's population is its slow growth relative to the rest of Florida. A study of the annual growth rate of the Northeast region's counties for the four years 1970 to 1973 clearly shows where the population increases are occurring most rapidly. Duval County grew at a rate of only 1.74% while the state as a whole grew at a rate of 4.78% during the period. However, the remaining four counties in the Jacksonville SMSA had relatively rapid growth, led by Clay with 9.0%.

Nonagricultural employment during March, 1972 is shown on Table J-12 reproduced from Northeast Florida, a publication of the Florida Department of Commerce (July, 1975). In northeast Florida, the retail and wholesale trades are the chief employers. Retail trade employment may be related to the size of the regional population and tourist flow. The volume of wholesale trade employment is unusually high due to the heavy port traffic through Jacksonville. Manufacturing employment in the region is concentrated in the five industries, paper and allied products, food and kindred products, transportation equipment, lumber and wood products, and printing and publishing.

The central Florida region consists of eight counties, as classified by the Florida Department of Commerce, and the central Florida area as defined in the April 1975 issue of Florida Trend also consists of eight counties. However, the regions differ slightly in the area included within the defined regions.

During 1974, the economy of the central Florida region was affected by the energy crisis, inflation and the recession, in that an excess of motel and hotel rooms led to a slowdown in new construction.

Construction layoffs and cutbacks in the national space program resulted in high unemployment rates in the region. Manufacturing jobs fell by 3,800 over the year to 25,800, with most of the loss in durable goods manufacturing industries.

Some concept of distribution of nonagricultural employment during 1972 can be gleaned from Table J-13 reproduced from Central Florida, a publication of the Florida Department of Commerce (1975).

According to Economic Development of Florida, Florida's position as the nation's leading tourist vacation destination is enviable. Tourism is the state's greatest single source of income and is one of the largest industries in the nation. During 1973, tourism boosted the Florida economy by more than $5.5 billion, contributing heavily to tax monies and, therefore, towards defraying the cost of state operations and improvement.

The number of Florida tourists was estimated by the Division of Tourism of the Florida Department of Commerce to have increased from approximately 11 million in 1960 to 25 million in 1973.

One reflection of the growth in tourism is the growth in the number of employees in the service group, which includes employees in hotels, motels, tourist attractions and related industries. This group was the most rapidly growing sector of the Florida economy, with 210,000 jobs added during the period 1963-1972. Another sector of the economy linked to the tourist market is retail trade. During the year 1972 approximately 490,000 persons were employed in the retail trade classification. More than half of the employment in retail trade is concentrated in food stores, eating and drinking establishments and merchandising.

Thompson (1975) reviewed some of the developments in the employment conditions in Florida. In March of 1974, there were 3,331,900 people in the labor force of Florida of whom 3,169,100 were employed and 162,800 were not employed. The unemployment rate was 4.9.

In March of 1975, the number of persons in the labor force had increased by 3.0 to a total of 3,432,100. The number of employed persons declined by 3.2% to 3,066,800. The increase in the number of persons in Florida who wanted to work plus the decrease in the number of persons who were actually employed caused the number of unemployed to more than double. In March, 1975, it stood at 365,300 or 124.4% more than were unemployed twelve months previously.

Thompson provided some comment on the employment in specified geographic areas of the state, and discussed employment in the various industries in the U.S. and Florida.

In comparing 1974 to 1973, Thompson commented that data from the U.S. Department of Labor indicated that more people were employed

Table J-12. Nonagricultural Employment in Northeast Florida, March, 1972

County	Total	Mfg.	Const.	Trans. & Public Utilities	Trade	Finance, Ins. & Real Estate	Services	Govt.	All Others
Alachua	48,280	3,360	3,520	1,300	8,400	1,700	4,180	21,400	4,420
Baker	2,320	140	40	40	240	40	100	1,460	260
Bradford	4,160	460	40	40	600	80	300	2,080	560
Clay	6,340	520	480	380	940	200	1,360	1,800	660
Columbia	10,480	1,940	200	320	1,960	240	1,240	3,060	1,520
Dixie	1,420	440	80	60	180	60	60	340	200
Duval	218,600	24,000	12,500	20,100	52,300	19,600	31,900	34,100	24,100
Gilchrist	1,000	20	20	20	140	20	20	640	120
Hamilton	2,660	380	20	40	320	20	880	600	400
Lafayette	460	80	20	20	60	20	60	180	20
Levy	3,500	720	380	120	560	60	160	760	740
Marion	24,700	3,760	1,380	1,020	6,520	1,020	3,220	4,280	3,500
Nassau	6,940	2,400	140	160	940	80	460	1,840	920
Putnam	10,120	3,320	260	380	1,900	220	760	1,720	1,560
St. Johns	9,400	1,120	580	580	2,120	280	1,920	1,480	1,320
Suwannee	5,320	460	140	380	1,680	180	640	1,000	840
Union	980	220	0	0	80	20	20	520	120
Northeast Florida	356,680	43,340	19,800	24,960	78,940	23,840	47,280	77,260	41,260

Source: Florida Industrial Commission, Research and Statistics Department, Basic Labor Market Information.

Table J-13. Nonagricultural Employment in Central Florida, March, 1972

County	Total	Mfg.	Constr.	Trans. & Public Utilities	Trade	Finance Ins. & Real Estate	Services	Govt.	All Others
Brevard	79,100	11,500	2,500	3,200	14,900	2,800	9,700	15,900	8,600
Flagler	1,160	200	40	20	200	20	220	300	160
Lake	23,160	2,500	1,400	1,120	5,840	720	3,620	4,040	3,920
Orange (and Seminole)	191,500	23,600	15,200	9,800	45,000	11,100	38,900	26,000	21,900
Osceola	8,440	980	580	140	1,960	360	1,260	2,040	1,120
Sumter	3,140	460	0	240	740	80	360	840	420
Volusia	57,600	5,400	3,000	2,200	13,400	2,900	11,200	9,200	10,300
Central Florida	364,100	44,640	22,720	16,720	82,040	17,980	75,260	58,320	46,420

Source: Florida Industrial Commission, Research and Statistics Department, Basic Labor Market Information.

1970 Employment by Occupation

Occupation	Central Florida (percent)	United States (percent)
Clerical and kindred workers	17.2	17.9
Professional, technical, and kindred workers	17.1	14.8
Craftsmen, foremen, and kindred workers	14.1	13.9
Service workers, Except private household	11.8	11.3
Managers and administrators, except form	9.7	8.3
Sales workers	8.6	7.1
Operatives, Except transport	7.2	13.7
Laborers, Except farm	4.7	4.5
Transportation equipment operatives	3.6	3.9
Farm laborers and farm foremen	3.1	1.2
Private household workers	2.2	1.5
Farmers and farm managers	0.7	1.9

Source: U.S. Department of Commerce, Bureau of the Census, Census of Population, 1970.

on the average in the nonagricultural sector in 1974 than in 1973 in both the nation as a whole and Florida.

Mining employment increased in both Florida and the nation, but it accounts for only 0.4% of Florida's employment and 0.8% of the nation's.

Average annual manufacturing employment remained almost unchanged in Florida with a drop of only 100 jobs from 1973 to 1974. However, in the nation there was an average annual loss of 38,000 jobs in manufacturing in 1974.

Average annual employment in 1974 in construction was 43,000 less for the U.S. as a whole and 12,300 less for Florida than in 1973. Thus, one out of every 3.5 construction jobs in the nation were lost in Florida.

More recently, construction employment, which on the average for the year 1974 was down only some 12,300, showed the tremendous decline of 75,000 from March, 1974 to March, 1975. A considerable part of the decline in manufacturing employment in Florida has taken place in industries related to building such as lumber and wood products, furniture and fixtures, stone, clay and glass products and fabricated metal products.

2. Projected Population Growth

The 1972 OBERS projections provide basic economic information in the form of near-term, mid-term and far-term projections of population, economic activity, and land use for the nation as well as geographic subdivisions of the nation. The projections include population, personal income, employment and earnings of persons, by industry.

The projections were developed by the Bureau of Economic Analysis of the U.S. Department of Commerce and the Economic Research Service of the U.S. Department of Agriculture for the U.S. Water Resources Council, an independent executive agency of the U.S. Government.

The areas for which data were prepared include functional economic areas known as BEA areas, water resource regions and sub-areas, the states and the District of Columbia, the Standard Metropolitan Statistical Areas, and the non-SMSA portions of economic and water resource sub-areas.

The Census Bureau periodically publishes several series of national population projections incorporating currently attained population, current birth rates, assumed future birth and death rates, and levels of international migrations. Projections based on Series C national population and the Series E national population projections have been published. The Series E projection assumes a birth rate which will eventually result in no further population growth except for immigration. These assumptions lead to an estimated national population of approximately 263.8 million for the year 2000, compared to an estimated 306.8 million population in the year 2000 provided by the Series C assumptions.

The OBERS projections are baseline or reference series and do not reflect the current energy problem, recent changes in agricultural exports, and recent changes in conservation and environmental activities and therefore, should be used with knowledge of these limitations.

Table J-14 incorporates the projected population (Series E) for the States of Florida, Georgia, North Carolina and South Carolina for selected years. These projected populations account for approximately 9.4% of the total U.S. population during the year 1970, and increase to approximately 11.16% of the total U.S. population in the year 2000. A large portion of the increased percentage is due to the increase in the projected population for Florida, although the population in each of the states is projected to increase during the thirty year period between 1970 and the year 2000.

The BEA Economic Areas that are located in the coastal region adjacent to the proposed sale include the following:

BEA Area 022, Norfolk-Portsmouth, Virginia
BEA Area 023, Raleigh, North Carolina
BEA Area 024, Wilmington, North Carolina
BEA Area 030, Florence, South Carolina
BEA Area 031, Charleston, South Carolina
BEA Area 033, Savannah, Georgia
BEA Area 034, Jacksonville, Florida
BEA Area 035, Orlando, Florida
BEA Area 036, Miami, Florida

A comparison of the population projections for the States of Florida, Georgia, North Carolina and South Carolina, as published in the Series E and Series C (Table J-15) volumes indicate some areas of similarity and some differences.

The population of the U.S. was projected to increase to approximately 307 million in the year 2000 in the Series C projection, and to approximately 264 million in the Series E projection. The population of the four states was projected to amount to 25.9 million by the Series C projection

Table J-14. Population (thousands) Trends for Southeastern U.S., Series E Projections

State	1970	1980	1990	2000
Florida	6,845.0	8,926.4	10,978.1	12,713.9
Georgia	4,602.0	5,147.3	5,907.4	6,458.1
North Carolina	5,091.0	5,736.3	6,464.7	6,972.9
South Carolina	2,596.0	2,818.5	3,121.9	3,319.4
Total 4 States	19,134.0	22,628.5	26,472.1	29,464.3
Total U.S.	203,857.8	223,532.0	246,039.0	263,830.0
Percent	9.4	10.1	10.8	11.2

BEA Area	1970	1980	1990	2000
022	1,234.1	1,224.4	1,325.7	1,386.6
023	1,624.1	1,788.1	2,009.2	2,159.9
024	482.9	471.5	516.0	544.0
030	401.6	436.9	474.7	491.9
031	431.7	407.9	434.1	447.6
033	418.9	423.4	445.7	452.0
034	1,057.0	1,234.1	1,425.7	1,569.9
035	951.4	1,209.2	1,440.0	1,622.3
036	2,452.8	3,408.4	4,408.0	5,300.6
Total	9,054.5	10,603.9	12,479.1	13,974.8
Total U.S.	203,857.9	223,532.0	246,039.0	263,830.0
Percent	4.4	4.7	5.1	5.3

Source: OBERS Projections (USDC, 1972).

Table J-15. Population (thousands) Trend for Southeastern U.S., Series C Projections

State	1969	1980	1990	2000
Florida	6,683.0	8,197.0	9,913.0	11,767.0
Georgia	4,570.0	5,335.0	6,230.0	7,176.0
North Carolina	5,051.0	5,713.0	6,430.0	7,321.0
South Carolina	2,578.0	2,914.0	3,277.0	3,729.0
Total	18,882.0	22,159.0	25,850.0	29,993.0
Total U.S.	201,877.0	234,208.0	269,759.0	306,782.0
Percent	9.4	9.5	9.6	9.8

BEA Area	1969	1980	1990	2000
022	1,227.3	1,327.9	1,424.2	1,549.1
023	1,611.9	1,733.5	1,904.9	2,109.7
024	480.7	505.9	550.8	601.3
030	402.0	431.1	476.7	530.0
031	425.5	470.7	523.9	575.9
033	420.1	452.3	494.4	540.8
034	1,049.1	1,225.1	1,429.3	1,632.2
035	913.7	1,173.7	1,464.3	1,784.2
036	2,381.2	3,016.6	3,714.5	4,469.8
Total	8,911.4	10,336.8	11,983.0	13,793.0
Total U.S.	201,877.0	234,208.0	269,759.0	306,782.0
Percent	4.4	4.4	4.4	4.5

Source: OBERS Projections (USDC, 1972).

in the year 1900, and to approximately 26.5 million by the Series E projection for that year.

This relationship suggests that with a smaller national population, an increase in the proportion of that smaller population will be located in the southeastern portion of the nation. A large number of this increased population was projected to be located in Florida, but population increases were projected to occur in each state.

Comparison of the projections of population for the coastal BEA areas reveals a similar relationship in that an increasing percentage of the total U.S. population was anticipated to occur in the nine BEA areas along the southern Atlantic coastline.

A comparison of the earnings projections developed in the Series E and Series C volumes for a sample BEA area (BEA 031 Charleston) is illustrated in Table J-16. For this economic area, projections of earnings are lower in the Series E projections than in the Series C projections.

3. Oil and Gas Industry in the U.S. South Atlantic Region

During the year 1974, approximately 3.6 x 10^7 barrels of crude petroleum were produced in the state of Florida from 136 oil wells. A comparison of the production and number of wells in 1974 and 1973 was published by the Bureau of Mines (USDI, 1975a).

Florida	1974	1973
Number of producing oil wells	136	147
Crude petroleum produced (thousand barrels)	36,351	32,695
Average value per barrel	$9.66	$4.59

During the first six months of 1975, 20,410 thousand barrels were produced in Florida, compared to 17,958 x 10^3 bbls during the same period in 1974.

As of December 31, 1974, the crude oil reserves in the State of Florida were estimated by the American Petroleum Institute (1975) to amount to 302,709 x 10^3 bbls.

There was no recorded crude oil production in the states of North Carolina, South Carolina and Georgia.

a. PETROLEUM REFINING

Petroleum refining activity is very limited in the Atlantic coastal areas of North Carolina, South Carolina, Georgia and Florida.

Pace Oil Company operates a Topping plant at Wilmington, N.C. According to the Bureau of Mines (USDI, 1975a) this plant does not process crude oil.

No refineries processing crude oil were listed for South Carolina.

The Amoco Oil Company operates a refinery located in the Savannah area. This refinery has a crude oil distillation capacity of 1.3 x 10^4 bbls/day and produces asphalt.

The Seminole Asphalt Refining, Inc. operates a refinery at St. Marks, Florida with a capacity of 6.0 x 10^3 bbls/day. This refinery is located adjacent to the Gulf of Mexico in the panhandle region of Florida.

Adjacent to the proposed sale area is an operating oil refinery located at Freeport in the Bahamas. This refinery is operated by the Bahamas Oil Refining Company, and the capacity of the refinery was listed at 5.0 x 10^5 bbls/day of crude oil capacity (Petroleum Publishing 1975).

Additional crude oil refining capacity is located in Puerto Rico and the Virgin Islands, as well as the coastal area of the U.S. in regions north of the boundary between the states of Virginia and North Carolina (Table J-16.1).

The Coastal Plains Regional Commission and eight co-sponsoring oil and petrochemical companies engaged R. R. Nathan Associates and the Coastal Zone Resources Corporation (1975) to investigate the technical, economic and environmental feasibility of developing deepwater terminals for unloading very large crude carriers off the coasts of North Carolina, South Carolina and Georgia. The views and findings expressed in this report were those of the consultants.

The consultants selected three representative sites for refinery complexes which we were chosen on the basis of minimization of environmental conflict that might be anticipated from construction of a deepwater terminal, refineries and related facilities.

The basic refinery module would be a 2.0 x 10^5 bbl/day unit. To handle projected throughput, therefore, three refineries would be required to be "on-stream" for the first year of deepwater terminal operations, and nine units would be required when crude volumes received by the deepwater terminal reached 1.8 x 10^6 bbls/day. The consultants also assumed, based in part on the demand analysis, that the growth rate between initial and final levels of throughput would be

linear. This means that during the 20-year project analysis period (1980-2000) one new refinery will come on-stream approximately every three years.

SOUTH CAROLINA

The South Carolina Development Plan, Fiscal Years 1974/1975, noted:

> South Carolina has also shown its willingness to acquire an oil refining capacity, to develop a deepwater terminal capable of accommodating the new large supertanker, and to support offshore Outer Continental Shelf (OCS) exploration and drilling. Outer Continental Shelf exploration is still in its planning stages and it will be years before drilling, if any, is begun off the South Carolina shore. The possibility of a deepwater terminal and oil refinery are much closer. Chevron Oil has purchased a potential refinery site along the Savannah River in Jasper County.
>
> The development of an oil refining capacity in South Carolina would require the construction of a deepwater terminal to accommodate supertankers, a pipeline system to transfer the crude oil, an onshore storage capacity, the total investment could range from $1.5 billion to $4.5 billion. The most likely geographical area in the state to locate such a network of facilities is the coastal area from Charleston to the Savannah River. The Coastal Plains Regional Commission, recently completed a study analyzing the environmental and economic feasibility of constructing a deepwater terminal and the accompanying refinery complexes. This study was done in conjunction with the Coastal Plains Regional Commission, North Carolina, South Carolina, Georgia, Ashland Oil, Chevron Oil, Cities Service Oil, Exxon Pipeline, Mobay Chemical, Mobil Oil, Shell Oil and Tenneco Oil.

GEORGIA

Georgia has also been mentioned as the possible site of an oil refinery. A study has been conducted by the State's Office of Planning and Budget to develop information regarding the probable impact which the development of a refinery might have on Coastal Georgia. The following discussion has been drawn from the publication, Summary of Petroleum Refinery Feasibility Study of Coastal Georgia, by the Office of Planning and Budget.

Two localities were selected as representative communities of the Coastal area to assess potential impacts of locating a refinery. Savannah was chosen as a representative urban site, and Darien as a representative rural site, but the conclusion drawn was that the Savannah area was the most feasible location for a refinery due to the superior harbor capacity and the fact that its size provides the many amenities necessary for such a huge undertaking.

The hypothetical refinery used in the study was assumed to have a processing capacity of 200,000 barrels per day, approximately 8 million barrels of storage space, and to require between 400 to 1800 acres of land. The construction force required would average 2000 over a period of two and one-half to three years, with a peak labor force of approximately 4,000 persons. Upon completion, permanent employment would likely be in the 500 to 600 range. The major portion of the total social costs of a refinery would result from a spill, with possible consequences of damage to the shrimping industry, commercial fishing and the oyster industry, and potential damage to tourism along Georgia's coastline. The summary also considered the need for additional transportation facilities, both marine and land based; and the social concerns of housing, education, and health, social and cultural services. Other factors that the summary considered were water supply and quality, air quality, noise abatement, and energy supply, and the impacts resulting from pipeline constuction.

Many questions not mentioned in the summary were raised and recommended for study, either immediately, or upon the proposal of a specific site and refining operation, should such a proposal be made at some future time.

NORTH CAROLINA

The Department of Administration of the State of North Carolina is preparing a study evaluating the possible impact of the construction and operation of a petrocomplex in the coastal area of North Carolina.

Three areas were selected incorporating civilian employment ranges from 14,000 to 85,400 (1995 Projected Baseline), and Low Growth and High Growth scenarios were specified.

Area III was identified as including the counties of Brunswick, New Hanover, and Pender. The example site in Area III was located approximately two miles north of Wilmington on U.S. 421, adjacent to an existing industrial complex along the west bank of the Northeast Cape Fear River. The

Table J-16. Comparison Between Series C and E Projections for Charleston, S. C. - BEA 031

Series C Projection - Earnings (thousand 1967 dollars)

	1969	1980	1990
AG. F. & F.	23,044	25,200	28,700
Mining	225	(S)	(S)
Cont. Cons.	56,699	85,300	126,100
Manufact.	148,508	238,200	353,500
Transport.	46,256	71,000	104,800
W & R Trade	115,384	189,500	288,100
Fire	29,560	47,400	72,300
Services	97,317	168,600	269,500
Gov't.	440,618	654,900	940,000
Total Earnings	957,609	1,481,000	2,183,900

Note: Columns may not add to exact totals shown.

Series E Projection - Earnings (thousand 1967 dollars)

	1970	1980	1990
AG.F. & F.	25,560	26,200	28,900
Mining	258	(S)	(S)
Cont. Cons.	59,119	74,200	100,300
Manufact.	148,529	207,500	283,700
Transport.	47,084	64,000	89,300
W & R Trade	118,200	157,700	210,300
Fire	29,776	50,700	75,900
Services	102,769	162,700	248,400
Gov't	469,343	556,100	747,700
Total Earnings	1,000,633	1,299,700	1,785,500

Note: Columns may not add to exact totals shown.

Source: OBERS projections (USDC, 1972).

Table J-16.1 OPERATING PETROLEUM REFINERIES IN THE WESTERN NORTH ATLANTIC REGION (January 1, 1976)

REFINER	LOCATION	CRUDE OIL CAPACITY BARRELS/CALENDAR DAY
Delaware		
Getty Oil	Delaware City	140,000
Maryland		
Amoco	Baltimore	15,000 (asphalt)
Chevron	Baltimore	13,500 (asphalt)
Virginia		
Amoco	Yorktown	53,000
Puerto Rico		
Caribbean Gulf	Bayamon	37,800
Commonwealth Oil and Refining	Penuelas	141,000
Sun Oil Co.	Yabucoa	68,300
Virgin Islands		
Hess Oil Virgin Island	St. Croix	728,000
Bahamas		
Bahamas Oil Refining	Freeport	500,000

SOURCE: Petroleum Refineries in the United States and Puerto Rico (USDI- BLM, 1976).

SOURCE: International Petroleum Encyclopedia, 1976 Petroleum Publishing, Tulsa, Okla.

availability of transportation facilities for petroleum and products was also considered.

Among other considerations being incorporated into the study are the need for electric generating capacity, and the local effects at the time of termination of the project.

B. NATURAL GAS

According to the Bureau of Mines data, during the year 1974 natural gas production in the State of Florida amounted to 38,137 x 10^6 ft3, compared to 33,857 x 10^6 ft^3 produced in 1973. The average wellhead value of this gas was 53.6/mcf, compared to 34.3/mcf in 1973 (USDI, Bureau of Mines, 1975c).

During the year 1974, natural gas was delivered to consumers in all four states (Tables J-17 thru J-19).

The Federal Power Commission has recently called attention to the ongoing natural gas supply shortages and has called attention to the national need for OCS oil and gas development as a substitute for increasing national dependence on foreign energy imports and/or future reliance on expensive synthetic fuels. (FPC March 11, 1977).

Additional comments on the use of fossil fuels in Florida and North Carolina have recently been provided to the Bureau of Land Management. Paula F. Hawkins, Chairman of the Florida Public Service Commission noted that fuel costs makeup anywhere from 40-60% of a given utilities total operating expense. Two of the largest electric utilities in Florida used more than five million barrels of oil products and five billion cubic feet of natural gas during February 1977. Additional energy was obtained from coal and nuclear power sources during this time.

Mr. Joe Sandlin, representing the natural gas distributing companies of North Carolina and the North Carolina Energy Policy Council, noted that there are three gas distributing companies in North Carolina. These companies are receiving between 30 and 65% of the natural gas contracted from an interstate pipeline company. Shortages of natural gas during early February 1977 resulted in the laying off of 8,450 people from their work, and 72 industrial, commercial, and school facilities in the state were closed.

A prime supplier of ammonia nitrate and ammonia nitrate solutions has been shut down since November 1, 1976, requiring imports of approximately one-third of North Carolina requirements from facilities in other states.

Table J-17. Production and Consumption of Natural Gas in Southeastern U.S., 1974. (Million cubic feet)

State	Marketed Production	Net Receipts Interstate	Transmission Loss 1/	Consumption
Florida	38,137	255,493	710	292,920
Georgia	0	335,472	5,133	330,339
N. Carolina	0	142,934	2,717	140,217
S. Carolina	0	137,102	5,111	131,991
Total	38,137	871,001	13,671	895,467
Total (U.S.)	21,600,522	882,495 2/	372,394	22,110,623

1/ Includes net change in underground storage
2/ In this table, this figure represents net imports of natural gas into the U.S.

Source: USDI, 1975c.

Table J-18. Consumption of Natural Gas in Southeastern U.S., 1974
(million cubic feet)

State	Total Consumption	Extraction Loss	Lease and Plant Fuel	Pipeline Fuel	Delivered To Consumers
Florida	292,920	3,369	2,700	3,081	283,770
Georgia	330,339	0	0	4,850	325,489
N. Carolina	140,217	0	0	4,496	135,721
S. Carolina	131,991	0	0	2,164	129,827
Total	895,467	3,369	2,700	14,591	874,807
U.S. Total	22,110,623	887,490	1,477,386	668,792	19,076,955

Source: USDI, 1975c.

Table J-19. Quantity of Natural Gas Delivered to Consumers in Southeastern U.S. 1974. (million cubic feet)

State	Total	Residential	Commercial	Industrial	Electric Utilities	Other[1/]
Florida	283,770	14,793	18,619	91,588	154,862	3,908
Georgia	325,489	76,207	41,189	161,879	43,086	3,128
N. Carolina	135,721	26,830	17,183	86,817	1,072	3,819
S. Carolina	129,827	20,383	13,618	73,114	21,510	1,202
Total	874,807	138,213	90,609	413,398	220,530	12,057
Total U.S.	19,076,955	4,786,128	2,262,909	8,305,979	3,429,231	292,708

[1/] Includes deliveries to municipalities and public authorities for institutional heating, street lighting, etc.

Source: USDI, 1975c.

K. Future Environment Without the Proposal

The population increases forecast for the states of North Carolina, South Carolina, Georgia and Florida are anticipated to take place independently of this specific proposed lease sale. Projections of the growth in population reflect national trends, and projections of the population in specific areas reflect economic opportunities present in these areas, as well as the choices of individuals and families in search of desired living arrangements.

With increased population and economic activity, there will be continued pressure on available land for development. In the region as a whole, undeveloped land suitable for residential, commercial and industrial use exists, but the most intense development pressures would probably occur in proximity to presently developed areas, a reflection of the urban and suburban developments of the past years. Competition for suitable land space between development needs and recreation needs, between new uses as well as traditional uses, and requirements for the transportation of goods and services produced in one area to other areas for consumption will continue.

Legislation concerning the efforts to harmonize and accommodate the necessary activities with the least environmental damage, or impairment of the alternative uses of areas containing several resources, is being developed on the national, state and local levels, and implementation of this legislation has been carried forward in many areas during the past few years.

Demand for recreation facilities can be anticipated to expand along the coastal portions of the southeastern U.S., and increased recreation facilities imply increases in transportation facilities in order to reach the recreation sites. Increased levels of industrial activity imply greater need for land use for industrial sites, residential areas, and public facilities to meet the requirements of larger populations.

In general, the increase in population, and the economic growth that may accompany the increase in population, implies a larger consumption of energy producing substances. "Energy Alternatives: A Comparative Analyses" (CEQ, 1975) presents a thorough discussion of various energy sources, both presently available and those which may prove to be of greater importance in the future.

In the event that this proposed sale is not held, no significant decrease in the amount of energy required in the region adjacent to the proposed sale could be attributed to the fact of cancellation. It is assumed that the men and materials, including the energy required, would be employed in other areas.

Energy requirements in the southeastern U.S. would be met from other sources. Altnernative energy forms that would meet requirements during the next decade appear to be nuclear, coal, and oil and gas from other sources. The most probable source appears to be oil products and natural gas imported into the region from other domestic areas or from foreign sources.

Section 3

Environmental Impacts of the Proposed Action

A. Basic Assumptions Utilized in the Analysis of Environmental Impacts

1. Day to Day Operations

The analysis in this section is based on the assumptions outlined in Scenario D (Section III.E.1.) which is deemed the most likely scenario of development to result, given the locational and resource assumptions provided by the USGS (Section I.C.). This scenario includes the following assumptions. Operations bases will be in Glynn County, Georgia; Charleston County, South Carolina; and Duval County, Florida. Oil transportation will be by pipeline to Duval County and Charleston County. Gas transportation will be by pipeline to Duval County and Charleston County.

Scenario D also assumes the high resource estimate provided by USGS, 1.0 billion barrels of oil, 6.8 trillion cubic feet of gas. To develop resources of this magnitude, about 220 exploration wells and 200 development wells will be required. These would probably be drilled to an average depth of about 3,048 m. Also, there would need to be about 25 drilling and production platforms, about 515 km of pipeline, 2 onshore oil terminals, and 2 onshore gas terminals. Peak daily production may reach 170,000 barrels of oil and 1,400,000 million cubic feet of gas.

The activities involved in achieving peak production are divided into six stages: geophysical exploration, drilling exploration, development, production, transportation and termination. For a detailed description, see Oil and Gas Operations, Appendix C. The assumption is made that normal operations as described below will be utilized for development likely to take place in the South Atlantic OCS.

a. Geophysical exploration

A number of geological and geophysical techniques have been developed over the years to assist in the prediction of petroleum occurrence. These methods include seismic refraction, seismic reflection, gravity, magnetics, bright spot technology, and stratigraphic correlation. Surface vessels of the 50 to 300 ton class are utilized to perform geophysical surveys. In general seismic surveys record the behavior of shock waves through various rock formations. This information is used to determine the presence of salt domes, folds, faults, sediment thickness and gas pockets. Shallow seismic surveys indicate the presence of potentially hazardous conditions to be avoided when locating a platform (Section II.A.6. Potential Geologic Hazards).

b. Exploratory drilling

Exploratory drilling operations are basically the same regardless of mobile rig type (jack-up drilling rigs, drillships and semi-submersibles). Initially, a drive casing is installed along with a blowout preventer. The casing is either jetted into place or driven into the bottom with a pile driver. Drill mud is circulated through the drill stem and casing to contain subsurface pressures and remove rock cuttings. Cuttings are washed and discharged overboard where they settle to the bottom. Some mud remains attached to the cuttings when they are discharged. As the cuttings cascade down through the water column, the mud is washed free and creates a turbid plume trailing with the prevailing surface current. The volume of drill cuttings generated and drilling muds is listed in Table A-1.

Otteman (1976) has considered the problem of drill cuttings and muds which result from offshore drilling and has presented the following analysis which is based upon experience in the Gulf of Mexico.

"The first 150± feet will be drilled or jetted with seawater. The resulting seawater mud will be returned directly to the sea floor without being pumped to the rig. While drilling the hole to 1,000 feet, typically only seawater will be used as drilling fluid; and it will be discharged overboard. When the formation clays do not make a viscous enough mud, some natural bentonitic clay will be added to the system. The discharged water amounts to approximately 7,000 barrels, (for a typical 10,000 ft well), and it will contain mostly natural mud generated while drilling the hole. Before running the conductor pipe to 1,000 ft, approximately six tons of bentonite clay will be added to the 1,000-barrel saltwater system. When the conductor pipe is cemented, this volume of bentonite clay in seawater will be discharged overboard."

"While drilling the remainder of the hole, the mud is continuously cycled back through the mud system. Some mud is discharged with the drill cuttings; and periodically drilling mud is discharged overboard to make room for natural mud made while drilling the hole. The maximum discharge will not exceed 200 barrels a day while

Table A- 1 VOLUME OF DRILL CUTTINGS GENERATED AND DRILLING MUDS

WELL TYPE	HOLE SIZE INCHES 10,000 FT	HOLE SIZE INCHES 18,000 FT	CUTTING VOLUME YD^3 10,000 FT	CUTTING VOLUME YD^3 18,000 FT	WEIGHT OF CUTTINGS REMOVED FROM HOLE TONS 10,000 FT	WEIGHT OF CUTTINGS REMOVED FROM HOLE TONS 18,000 FT	TOTAL MUD VOLUME (INCL. HOLE VOLUME BBLS 10,000 FT	TOTAL MUD VOLUME (INCL. HOLE VOLUME BBLS 18,000 FT	DRILLING MUD TYPE
INTERVAL BELOW MUDLINE (FT)									
0-150	36	36	39	39	72	72	As required		Seawater and natural mud
150-1,000	25	32	108	176	203	332	As required		Seawater-gel natural mud
1,000-4,500	18	20	229	283	448	534	1800	2200	Seawater-gel Lightly treated mud
4,500-10,000	11	-	135	-	272	-	1600	-	Seawater/fresh-water - lignosulfonate mud
4,500-12,000	-	15	-	342	-	690	-	2800	Seawater/fresh-water - lignosulfonate mud
12,000-18,000	-	10	-	121	-	262	-	2000	Freshwater lignosulfonate mud
		TOTAL	511 YD^3	961 YD^3	995 TONS	1890 TONS			

Source: Otteman, 1976.

drilling to 5,000 feet and 50 barrels a day from 5,000 to 10,000 feet. During approximately 20 days of drilling to 10,000 feet, some 2,000 barrels of bentonite clay and lignosulfonate treated mud would be discharged overboard. We would possibly begin converting the mud system from a seawater gel mud to a lignosulfonate treated freshwater mud at around 6,000 feet. This decision would be based on the relative economics of hauling freshwater from shore versus the higher maintenance cost of saltwater muds. During the additional 70 days operations while drilling from 10,000 to 18,000 feet, the discharge rate will not exceed 50 barrels a day; approximately 4,000 barrels of lignosulfonate drilling mud would be dumped overboard. When the well is completed, the mud remaining in the surface system is discharged overboard; and this can amount to as much as 800 barrels."

The typical composition of gelled seawater and lignosulfonate treated muds are listed in Table A-2.

c. DEVELOPMENT

Field development drilling creates the same effluents as exploratory drilling only spatially more concentrated since as many as 10 to 20 wells may be drilled from a single platform. Observations in the Gulf of Mexico indicate that these drill cuttings form low mounds on the seafloor with a maximum relief of approximately 20 cm. These cuttings will be worked into the surrounding sediment by bioturbation or colonized by sessile organisms to form a miniature reef.

D. PRODUCTION

The production phase of OCS oil and gas operations consists of those steps necessary to bring the product to the surface and prepare it for transport. Production wastes include formation waters associated with the extracted oil, sand and other solids removed from the formation waters, deck drainage from the platform surface, and sanitary wastes. The sand is disposed of directly unless it contains oil in which case it must be treated before disposal. Formation waters are relict sea water but with anomalous ion ratios. The ranges of constituents found in produced formation water offshore Louisiana are listed in Table A-3. The sanitary wastes from offshore oil and gas facilities are composed of human body waste and domestic waste such as kitchen and general housekeeping wastes. Combustible solids are burned on site and non-combustibles are transferred to shore for disposal.

E. TRANSPORTATION

Transportation of the products which may be produced from the area may require the installation of large diameter (61 to 91 cm) pipelines. Installation of pipelines will require the jetting or cutting of these lines into the sea bottom to a minimum depth of 0.9 m. The suspended sediments fall diffusely along either side of the trench and the pipeline eventually becomes covered by the reworked sediments. Turbidity created by such an operation, although temporary, must be considered as a disturbance. As the pipeline comes ashore, a corridor two to four meters wide will be disturbed. Chronic oil leaks are potential effluents from transportation via pipeline.

An alternative to pipeline transportation would be transportation via oil tanker which would increase the risk of spillage. This alternative is examined further in Section VIII.D. The USGS (1976) has considered the transportation of potential production from the proposed lease sale as follows:

> "It can be anticipated that, due to the dispersion of tract locations in proposed sale area, their distance from shore, and the anticipated small pool sizes, initially transportation of oil would be via tankers. Tankers would probably be of the 16,000 to 25,000 dead weight tons (dwt) class. Furthermore, unless or until strategically convenient deliverability of about 70,000 barrels of oil per day (BOPD), the construction of an oil pipeline to shore is doubtful. Based on this empirical rule of thumb, no more than two oil pipelines are predicted to result from the subject proposed sale. The initial dependence on tanker transport is foreseen for three to five years after production is commenced. This time frame of course is subject to the timing and quantity of resource discoveries. Therefore, in the period 1982-84, an investment decision can be anticipated on whether or not to construct an oil pipeline to shore."

Areas of Potential Transportation Activity

Consideration has been given to the possible installation of pipeline facilities that may result from proposed Sale No. 43.

It is difficult to establish precise routes that pipelines would follow prior to the discovery of hydrocarbon resources. However, assumptions

Table A-2 TYPICAL MUD COMPOSITION - SEAWATER GEL MUD

This type mud is typically used to drill from the base of the conductor casing to the surface casing point. Generally, the seawater gel system will be used from less than 1000 feet to a maximum of 4500 feet. The components used to make up and maintain the required characteristics of this mud system are:

Mud Components	Lbs/Bbl of Mud
1. Drilled Solids	48-60
2. Bentonitic Clay	30-40
3. Caustic - Sodium Hydroxide	0.5-1.5
4. Mica Flakes (Lost Circulation Material)	0.0- .5
5. Cellulose Polymer	0.0-.25
6. Seawater	As required - approx. 10#/bbl salt from the seawater

LIGHTLY TREATED LIGNOSULFONATE SEAWATER/FRESHWATER (6,000-8,000 ppm Cl^-) MUD

As the hole is deepened below surface casing it becomes necessary to start adding additional materials to maintain the desired mud characteristics. Slowly fresh water is substituted for sea water as the depth and temperature increase. A typical 10.0-10.5 pound per gallon lightly treated lignosulfonate system used to about 10,000 feet would include:

Mud Components	Lbs/Bbl of Mud
1. Drilled Solids	55-70
2. Bentonitic Clay	20-30
3. Barium Sulfate - Weight Material	45.60
4. Caustic - Sodium Hydroxide	1.0-2.0
5. Lignosulfonate	4-6
6. Lignite	0.0-3.0
7. Cellulose Polymer	0.0-.25
8. Seawater/Freshwater	As required - approx 5#/bbl salt from 50/50 seawater-freshwater

LIGNOSULFONATE FRESHWATER (3,000-4,000 ppm Cl^-) MUD

The deep portion of a typical well (below approximately 10,000 ft.) would require a freshwater lignosulfonate mud system in order to maintain the mud properties as desired for proper hole maintenance. A typical 10.0-11.0 pound per gallon lignosulfonate treated mud system would include:

Mud Components	Lbs/Bbl of Mud
1. Drilled Solids	65-80
2. Bentonitic	20-30
3. Barium Sulfate - Weight Material	55-150
4. Caustic Sodium Hydroxide	1-2
5. Lignosulfonate	4-8
6. Lignite	3-8
7. Defoamer/Detergents	0.5
8. Fresh water	As required

Source: Otteman, 1976

TABLE A-3 MEDIAN CONCENTRATION OF TRACE METALS IN PRODUCED WATERS[1/]

Median Concentration (equaled or exceeded by 50% of the samples) in Each Area

	Number of Samples	Total Solids (madian) (g/1)	Co	Cr	Cu	K	Li	Mg	Mn	Ni	Sn	Sr	Ti	V	Zr
Illinois Basin	22	98	ND	2p	10p	300	15	6,000	175p	ND	< 1p	300	<10p	ND	<10p
Louisiana and Texas Gulf Coast	79	69	ND	<1p	<25p	300	ND	250	3.5	<1p	< 1p	85	<10p	ND	<10p
East Texas	88	66	ND[3/]	ND	< 1	50	ND	250	3.3	<1p	3p	350	ND[3/]	ND[3/]	ND
North Texas	24	222	ND	<1p	150p	300	ND	5,000	45	15p	12p	450	7p	ND	<10p
West Texas and New Mexico	148	111	ND	2p	1p	350	15	1,000	1.8	<1p	< 1p	200	<10p	ND	ND
Parmian only	74	143	ND	2p	2p	400	10	1,000	1.7	<1p	< 1p	90	<10p	< 1p	ND
Pennsylvania only	34	115	ND	3p	< 1p	300	10	1,000	2.8	<1p	< 1p	300	<10p	< 1p	ND
Silurian-Devonian only	15	55	ND	2p	4p	300	10	400	300p	<1p	1p	90	<10p	ND	ND
Ordovician-Cambrian only	21	67	ND	<2p	4p	400	15	800	400p	<1p	1p	250	<10p	ND	ND
Anadarko Basin[4/]	118	137	ND	10p	10p	250	10	1,550	5.6	6p	2p	300	<10p	< 1p	<10p
Williston Basin, post-Paleozoic	25	59	<5p	<2p	<25p	300	ND	250	300p	<3p	< 1p	100	ND	< 1p	ND
Williston Basin, Paleozoic	55	173	ND	3p	3p	800	35	600	660p	ND	< 1p	95	<10p	< 1p	ND
Powder River Basin	22	5	<5p	<2p	<25p	300	ND	40	450p	<3p	< 1p	25	<10p	< 1p	<10p
Other Wyoming	28	5	ND	ND	ND	300	ND	100	300p	ND	< 1p	20	<10p	< 1p	ND
Colorado	18	5	<5p	ND	<25p	300	ND	30	300p	<3p	<10p	20	<10p	< 1p	<10p
California	116	18	ND	5p	5p	45	ND	90	950p	10p	2.5p	10	<10p	< 1p	ND
Seawater	-	35	0.27p	0.04p-0.07p	1p-15p	380	0.1	1,272	1p-10p	5.4p	3p	13	Present	0.3p	ND
Estimated Detection Limit	-	-	1p	1p	1p	50	2	10	1p	1p	1p	16	10p	1p	10p

1/ Taken from Rittenhouse, Fulton, Grabowski, and Bernard

2/ ND = below detection limits; p = concentration in parts per billion, otherwise parts per million

3/ No data; less sensitive methods of analysis used.

4/ Includes Oklahoma Platform and Ardmore Basin.

Source: "Environmental Aspects of Produced Waters from Oil and Gas Extraction Operations in Offshore Coastal Waters, prepared by OOC, Sept., 1976.

can be made, and tentative areas designated that may provided feasible lineations for pipeline installation.

For proposed Sale No. 43, the Geological Survey estimated that between 2 to 4 pipelines, each approximately 80 miles long, would be required. The estimate applicable to the high resource estimate was for 2 oil and 2 gas pipelines. The Geological Survey also provided an estimate that 2 onshore terminals would result from the sale.

The most probable destination point for crude oil produced as a result of the sale would be existing petroleum refineries. Since no general purpose petroleum refineries are located in the coastal portions of the southeastern states, the most probable assumption to make is that the oil would be transported to shore, stored, and transhipped by tanker to existing refineries in other areas. Transportation from the producing areas to the onshore terminals would probably be done by surface transportation during the initial stages, and by pipeline in later stages in the event that the reserves discovered were in large enough quantity. Existing natural gas transportation lines were assumed to be onshore destination points for OCS gas production.

These considerations led to the adoption of the assumption that the Charleston, S.C. and Jacksonville, Florida regions were potential landing points for OCS produced oil and gas that may result from proposed Sale 43, since 80 mile arcs from these centers reach the 8 subdivisions of the proposed lease offering (refer to USGS Open File Report 76-653 in Appendix M).

The oil spill risk analysis performed for the sale selected three points along transportation lineations, designated A, B, and C, and computed the probability of impacts upon other resource groups from spills originating at these points. Points A and C are the points most applicable to the scenario discussed in Section III. The assumption incorporated into the landing points specifies that Duval County, Florida and Charleston County, South Carolina would be the hypothetical areas of pipeline landfall.

Within the areas outlined by the eastward limits of the proposed tracts and the northern and southern boundaries of the two counties, and line segments connecting these eastern and western limits, marine pipelines may be constructed.

More precise designations of pipeline routes could be estimated when more precise information regarding the location of oil and gas deposits, the quantities of oil and gas, the presence of other valuable resources, and the future availability of facilities for processing oil and gas that might be constructed regardless of the outcome of this proposed sale.

These areas have been outlined on the map in Figure A-0.1.

f. TERMINATION

According to industry estimates, with proper placement of wells and sufficient pipeline capacity, a gas reservoir could be drained in as little as 10 years. In contrast, some oil reservoirs have been producing for over 20 years. When a reservoir has been depleted to a level at which it cannot be profitably produced, operations are terminated.

OCS Orders (see Appendix G) requires wells to be plugged, the casing severed well below the mudline, the platform removed, and all obstructions cleared from the area. Major trunklines may be used for future production from adjacent areas, but smaller lines would probably be abandoned in place. Abandonment consists of purging the lines of entrained hydrocarbons by water flushing (the water disposed of onshore) and severing the ends below the mud line. The necessity for removal of pipelines nearshore is usually regulated by the State. Removal of nearshore pipelines has been completed in isolated cases in the Gulf of Mexico.

2. Effects of Potential Geologic Hazards on Offshore Operations

Impacts of potential geologic hazards are discussed under four categories: seismic hazards, bottom conditions, near-surface hazards, and geopressures.

The only major earthquake large enough to have caused an impact on operations in the proposed sale area was the Charleston, S.C. earthquake of 1886. This quake had a magnitude of IX to X (modified Mercalli Scale of 1931) and effected an area within a radius of over 1,287 km (800 mi). More than 400 quakes have occurred in the Charleston area since 1754 (Bollinger, 1972). The potential for seismic effects is therefore presumed to exist, but the probability seems low and the magnitude moderate.

However, only one earthquake is known to have occurred offshore. This one, in 1960, occurred near Charleston at 33° N. latitude and 80°

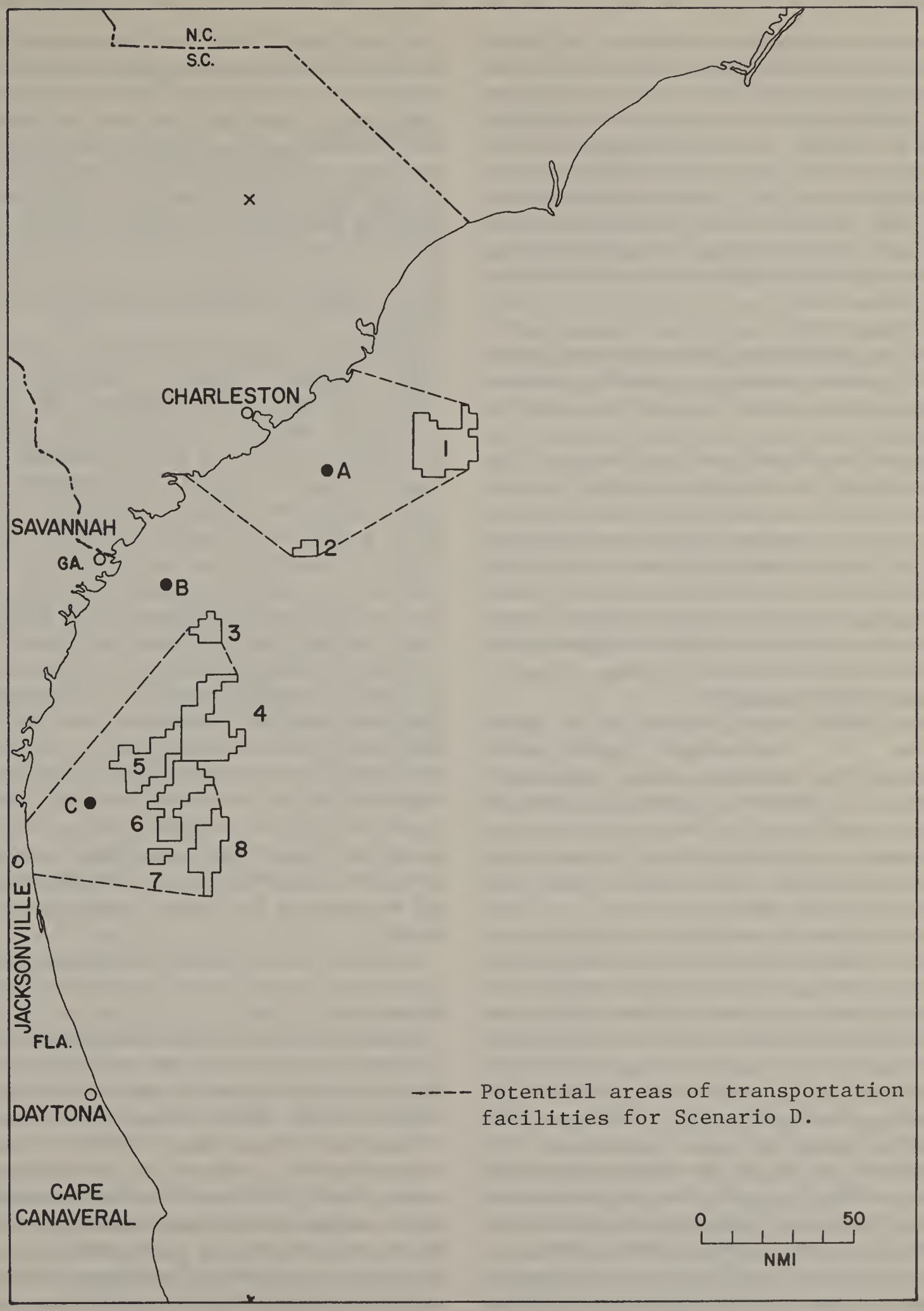


Fig. A-0.1 Map of the South Atlantic Outer Continental Shelf showing subdivision of the proposed lease area and hypothetical transportation routes.

W. longitude and was of magnitude V (Coffman and von Hake, 1973). The Charleston quake occurred some 113 km (70 mi) west of the area of high nominations interest. Although the probability of a damaging earthquake is rather low, the Charleston area is rated as Zone 3 on the Seismic Risk Map of the U.S. (Perkins, 1974; Algermissen, 1969). A Zone 3 is one in which may occur a major destructive earthquake which corresponds to intensity VIII and higher on the Modified Mercalli Scale of 1931.

If a large earthquake did occur, damage, injury, death and oil spills could occur in offshore operations. Pipeline disruption, especially nearshore where quakes are more frequent, could result in spilled oil.

Impacts on offshore operations caused by bottom conditions would result primarily from sediment movement. As stated in Section II.A.6.b., the presence of primary sedimentary structures such as cross-bedding, ripple marks and grading bedding indicate active deposition or redeposition. The damage that could occur in offshore operations as a result of this dynamic sedimentary environment could be caused by scour around the bottom of platform supports.

Good support would be found in the dense, medium- to coarse-grained sands which predominate the sedimentary regime of the South Atlantic OCS. However, standard site selection surveys must be used in final site selection for platforms, as scattered patches of lagoonal muds and peats do occur. These patches would offer poor support capabilities.

The existence of sandwaves are indicated in Figure A-5 (Section II.A.) on the South Atlantic OCS. Standard geophysical surveys would locate these features prior to site selection. Similar features with foreslope dips up to 5°± and backslope dips of up to 15°± have been reported on the Mid-Atlantic OCS, directly to the north (USGS, personal communication, 1976). Slopes of this magnitude associated with sand waves will probably not be found on the South Atlantic OCS.

Near surface hazards, such as hard-bottom areas will have to be contended with on the South Atlantic OCS. The precise locations of most of these hard-bottom occurrences are not known at the present time, but they are known to occur in "trends". The tracts with reported occurrences of hard-bottom communities are as follows: 3, 10, 12, 13, 16, 33, 40, 41, 43, 45, 46, 49, 69, 116, 117, 118, 130, 131, 132, 143, 144, 145, 203, 223, and 224. There are many more tracts that occur in the trends (see Visual No. 4S). Until a mapping program can be completed, we must assume that these features occur in all tracts. These hard-bottom areas, cemented sedimentary rock outcrops in most cases, would result in difficulties in trenching operations for pipelines. Damage to a platform could result from the placement of supports in one of these areas, since scarps are common in these zones and the rock units tend to be brittle.

Impacts to offshore operations caused by creep, slumping, gasification, subsidence and near-surface faulting are negligible since these features are much less common than in the Gulf of Mexico. The Gulf of Mexico sediments have been deposited very rapidly with a high degree of muddy sediments whereas the sediments of the South Atlantic OCS consist of more carbonate and sandy material. The principal areas where creep or slumping would have to be contended with would be on the continental slope where the clays found there are only semi-consolidated.

Impact on drilling operations by geopressures are entirely speculative at this time. In the Mississippi area a slightly over-pressured section was found in the Tertiary strata. Wells in up-dip locations encountered by hydrostatic pressures while those in down-dip or seaward locations encountered geopressures. Whether these geopressures extend to offshore Georgia and South Carolina is not known, but geopressure is not encountered in the Jay field (in the Florida panhandle) (Visual No. 9).

Hydrogen sulfide (H_2S) in formation gases would be a hazard to crews involved in drilling operations.

In conclusion, the most significant of the potential geologic hazards, and the most likely to impact the offshore operations on the South Atlantic OCS, would be seismic hazards in the form of earthquakes. Although the probability of a significant earthquake is deemed very low, if one did occur it could result in a financial and time loss due to damage or loss of equipment. Injuries, loss of life and possible oil spills could also result from such an earthquake. The impacts of offshore operations resulting from bottom conditions, near-surface hazards and geopressures would be negligible since they would be mitigated through current practices utilized in site selection surveys

and drilling procedures. Hard bottoms could impede pipeline burial and would have to be contended with.

3. Effects of Oceanographic and Meteorological Conditions on Offshore Operations

Sections II.V. and C. discussed in detail the existing information on the physical and chemical oceanographic conditions of the U.S. South Atlantic OCS.

The surface water temperatures of the western North Atlantic south of Cape Hatteras, being directly dependent upon seasonal air temperature, seldom fall below 12° C (53.6° F) nearshore in the winter and are even warmer offshore due to the warming effects of the Gulf Stream. These temperatures, although low enough to cause discomfort and minor loss of efficiency in personnel involved in offshore operations, are not as severe as those faced in Alaska, the North Sea or Celtic Sea, where successful operations have taken place. Water temperature, therefore, will probably have little impact on offshore operations.

The surface circulation (Section II.B.3.b) of around 16.5 km/day (9 nautical miles/day), with tidal circulations (Section II.B.5.) of up to 23 km/day (12 nautical miles/day), are considered to be negligible. Current up to 17 km/hr (9 knots) are contended with daily by operations in Cook Inlet, Alaska. Therefore, the lower speed water movements of the U.S. South Atlantic OCS should not present any problems. One possible impact on offshore operations by circulation of water masses would be in the form of scour around the base of jack-up rigs by bottom currents, thereby causing foundation instability.

Sea level variations caused by tides, storm surge and annual average variation would have little, if any, effect on operations on the South Atlantic OCS. Tidal variation on the continental shelf has a maximum range of 1.8 m (6 ft) nearshore and decreasing further offshore (Visual No. 6N and 6S). This range would have no impact on operations

The most important impact of physical oceanographic conditions on offshore operations would be that of waves. Since the vast majority of sea waves are wind-generated, there is a great deal of overlap in the discussion of oceanographic conditions and meteorological conditions. Section II.B.4. and II.D. discuss in detail wave and meteorological conditions, respectively, on the South Atlantic OCS. Comparison between this and other operating regions indicates that petroleum operations have been, and are, carried out in more severe conditions than will be faced as a result of this proposed sale.

Sexton (1976) stated that jack-up rigs can operate with wind speed limitations of approximately 97 km/hr (50 mph), drill ships with wind speeds of 48 km/hr (30 mph) and wave heights of 4 m (12 ft), and semi-submersibles with winds of 80 km/hr (50 mph) and 11 m (35 ft) waves.

We can see from Figures B-36 through B-38 (Section II.B.4.) that the expected frequency for waves higher than 6 m (20 ft) is less than 3% in the month of November in the proposed lease area. Therefore little down time due to weather and seas is expected compared with other areas currently under development. A SEDCO semi-submersible on the Canadian shelf of Vancouver Island recorded sustained winds of 121 km/hr (74 mph) with gusts to 161 km/hr (100 mph) accompanied by waves up to 29 m (95 ft) during a severe storm (Sexton, 1976). Hurricanes passing through the Gulf of Mexico, such as Camille, have generaged winds of 201 km/hr (125 mph) and 22 m (72 ft) waves (Patterson, 1976). Such extreme conditions as these are rarely expected in the South Atlantic OCS.

According to Feder (1975), North Sea wave heights are greater than 2.5 m (8 ft) for 16-18% of winter. In the Celtic Sea, daily maximum wave heights exceed 3 m (10 ft) 40% of the year and 6 m (20 ft) for 5% of the year (Oil and Gas Journal, 1975). Data indicate, therefore, that periods when operations will be suspended due to high seas will be less frequent than occur in the North or Celtic Seas. According to USGS (Conservation Division, Washington, D.C., personal communication, 1976), operations were safely conducted on the COST (Continental Offshore Stratigraphic Test) well drilled off New Jersey from December, 1975, to March, 1976. During that period, operations were suspended for a total of only 24 hours due to weather and seas. Conditions in the South Atlantic are expected to be less severe.

According to VIMS (1974), visibility is reduced to less than 3.7 km (2 nautical miles) on the average of one percent per year primarily in winter, in the proposed leasing area. Visibility reduction due to fog is faced regularly by operators in the Gulf of Mexico and the North Sea. These conditions may briefly limit supply of crew

activities by helicopter, and slow down boat movement.

4. Probability of Oil Spills in the U.S. South Atlantic Region

Operational activities in the northern Gulf of Mexico (1964-1976) appear to be the most representative of anticipated offshore oil and gas operations in the U.S. South Atlantic region. It should be noted that the physical environments of these two areas are not exactly alike. More hazardous environmental conditions in the South Atlantic OCS might increase the probability of oil spills over that of the Gulf of Mexico OCS experience. However, statistical data obtained from the North Sea (a more severe operating area than the U.S. South Atlantic) do not support this assumption at this time. Because operating equipment and personnel programs were designed proportional to the harsh conditions expected. No significant pollution accidents have occurred in the North Sea in drilling about 700 wells during a period of about 10 years (USDI-BLM, 1976b). The assumption is made for the South Atlantic that experience there will be similar.

Operational oil spills statistics for the Gulf of Mexico can be used to estimate the probability of oil spills for the proposed sale area. The Gulf of Mexico records represents the most extensive data with respect to all phases of OCS oil field development in the United States.

The most important feature of oil spill statistics as reported by the CEQ (1974) is the size of individual spills. The statistics represent oil spills of all types (exploration, production, collisions, etc.) ranging in size from a few gallons to 150,000 barrels. Most spills are at the low end of this range. For example, in 1972, 96% of the spills were less than 24 barrels (1,000 gallons) and 85% were less than 2.4 barrels (100 gallons). A few very large spills account for most of the oil spilled. The *Torrey Canyon* accident of 1967 (860,000 bbls), for example, spilled twice as much crude oil as was reported spilled in the United States in 1970. In 1970 and 1972, three spills each year accounted for two-thirds of all the oil spilled in the United States navigable waters in those years. Because the total volume spilled per incident can vary by factor of one million, it is difficult to estimate average amounts that might be spilled during the life of any field (Devanney and Stewart, 1974). Data supplied by the U.S. Geological Survey for the total period of 1964-1976 in the Gulf of Mexico indicates a total of 55 significant pollution incidents (50 bbls or more) connected with Federal OCS oil and gas operations.

On December 15, 1976 the Liberian-registered tanker ARGO MERCHANT ran aground on the Nantucket Shoals. The tanker broke apart on December 21, spilling 7.6 million gallons of No. 6 fuel oil. On January 4, the spill was floating 145 km (90 mi) from the coast covering an area 346 km (215 mi) long and 161 km (100 mi) wide. The spill was reported to have been caught up in a Gulf Stream eddy about 241 to 322 km (150 to 200 mi) east-southeast of the original spill site. If the spill was caught in the eddy of warmer Gulf Stream water, then the process of degradation and dispersion would be accelerated.

The estimated total volume of oil spilled during this period as a result of these incidents is over 326,000 barrels (13.7 million gallons). Table A-4 illustrates the distribution of Gulf of Mexico incidents as to type and barrels spilled. For example, pipeline breaks and leaks account for 29.1% of the 55 incidents but were the cause of 61.4% of oil spilled. Conversely, production equipment malfunctions of all types amounted to 36.4% of incidents and 20% of oil spilled (USDI-GS, 1976e). Table A-4 is discussed further in the following subsections.

It is assumed that tanker or barge transportation will be utilized initially to bring South Atlantic production to shore. As production increases, from two to four oil or gas pipelines may be constructed and used to transport oil and gas to onshore terminals. Onshore terminals will be used to load tankers for distribution to existing treatment facilities outside the area. The following discussion outlines the probabilities estimated from past experiences, of oil spills caused by pipeline accidents, well blowouts, fires, tankers, and natural phenomena.

a. PIPELINE ACCIDENTS

Since the USGS OCS Operating Orders concerning pipelines went into effect in 1970, pipeline breaks and leaks accounted for 29.0% significant pollution incidents and 27.7% of oil spilled. These data refer to the Gulf of Mexico which has the largest Federal OCS record and the most offshore pipeline activity of any area in the United States. Oil spilled by pipeline accidents account for approximately 0.0014% of the total production in the

Table A-4. Oil Spills Greater than 50 Barrels in the Gulf of Mexico, 1964-1976

Cause of Spill	Number of Incidents	% of Incidents	Barrels of Oil Spilled	% of Oil Spilled
1. Blowout	5	9.1	5,138	1.6
2. Hurricane Damage	6	10.9	14,357	4.4
3. Pipeline Breaks & Leaks				
a. Unknown Cause	7	12.7	8,209	2.5
b. Corrosion	4	7.3	5,564	1.7
c. Anchor Dragging	5	9.1	186,652	57.2
Subtotal	(16)	(29.1)	(200,425)	(61.4)
4. Fires	1	3.6	30,600	9.4
5. Barge Spills	3	5.5	7,340	2.2
6. Collisions	3	5.5	2,825	0.87
7. Production Equipment Malfunction				
a. Valves	4	7.3	365	0.11
b. Overflow of Vessel or Tank	10	18.2	1,113	0.34
c. Workover	1	1.8	53,000	16.2
d. Well Abandonment	1	1.8	500	0.15
e. Other Equip. Failures	4	7.3	10,500	3.2
Subtotal	(20)	(36.4)	(65,478)	(20.0)
Total	54	100.1	326,163	99.87

Source: USDI-GS, 1976e.

Gulf of Mexico. Assuming the USGS estimates of recoverable resources, between 0.282 and 1.009 billion barrels of oil could be produced from this proposed sale, from 3,948 to 14,126 barrels might be spilled by pipelines during the 25-year expected life of this lease area.

Since 1970, 72.9% of the total volume of oil spilled by pipelines and 37.5% of accidents are believed to be the result of ship anchors dragging across the pipeline causing it to rupture. Other causes of pipeline damage include movement due to wave action during storms, impact of trawl boards of commercial fishing boats, and corrosion of the pipe due to formation water that is produced with the oil. The pipelines are protected cathodically with zinc anodes and an internal corrosion inhibitor is injected with production through the line. But occasionally small pits form on the interior walls of the pipeline as the line gets older.

Taking the USGS high recovery estimates, there will be a total of 160 miles of oil pipelines constructed during the 25-year life of the field. In the Gulf of Mexico there is currently over 7700 miles of oil and gas pipelines. At least 1000 miles of those 7700 miles are oil pipelines. According to USGS there have been 16 pipeline breaks and leaks of over 50 barrels of oil from 1964 to 1976 (Table A-4). There have been 6 spills of the 16 that were greater than 1000 barrels each. It would be logical to assume there will occur at least one spill greater than 1000 barrels during production from the South Atlantic leasing area.

B. OIL AND/OR GAS WELL BLOWOUTS

It is possible for oil or gas to blow out of control during drilling operations, completion and production. Blowouts may be prevented during drilling by increasing mud weight and activating blowout preventers. When a well is completed, a subsurface safety device is installed to prevent the well from blowing out if surface control is lost. A gas well blowout will cause little or no pollution because it will burn or disperse into the atmosphere. An oil well blowout can release large quantities of drill mud, cuttings, sediment and some oil and gas into the marine environment.

Gulf of Mexico statistics show that during the period of 1956 to November 1, 1976 one blowout occurred for every 231 wells drilled, spilling an average of 1,053 barrels of oil each. Although there have been a total of 60 well blowouts since 1956, only 8 have resulted in significant volumes of oil spillage. In fact a single incident accounts for spillage of 53,000 barrels of the total of 63,193 barrels spilled by blowouts in the last 21 years in the Gulf of Mexico. Most blowouts causing spillage result from producing oil wells, not wells being drilled. Producing oil well blowouts are normally a result of equipment malfunctions, workover procedures, human errors, storms and collisions.

It is estimated that between 255-720 exploratory and development wells will be drilled as a result of the proposed sale. Based upon the above statistics in the Gulf of Mexico, there may be between one to three blowouts resulting in approximately from 1,053 to 3,159 barrels of oil spilled during exploration and production in the U.S. South Atlantic lease area.

C. OIL SPILLS RESULTING FROM EXPLOSIONS AND FIRES

Combustible hydrocarbon liquids or vapors making contact with arching electrical or overheated mechanical devices undoubtedly cause most platform fires. More rarely, they are ignited by lightning or static electricity. Sometimes platform fires involve the accidental ignition of fuel, solvent or heat exchanger fluids.

If producing wells are damaged to the extent that oil flows freely and ignites, they are usually allowed to burn while remote control operations are underway. In this way, most hydrocarbon liquid expelled by the well burns, reducing the fire hazard during relief operations and lowering ocean pollution levels. If a blowing well is releasing mostly natural gas, ocean pollution is minimal. However, personnel and the platform or drilling structure are imperiled in the event of a fire.

From 1956 to November 1, 1976 platform fires of varying species have occurred during OCS production in the Gulf of Mexico. Most were extinguished without causing serious damage or pollution. Of 189 recorded explosions and fires, only 19 resulted in oil spills amounting to a total of 87,132 barrels. Approximately one explosion and/or fire occurs for every 74 wells drilled, spilling an average of 461 barrels of oil. Assuming that a minimum of 255 and a maximum of 720 wells will be drilled as a result of this proposed sale, between 3-10 explosions and/or fires may result during the expected production period.

D. TANKER ACCIDENTS AND OPERATIONS

Because of the low resource estimates, distance to shore, economic considerations, and the position of the tracts in relation to one another, it is more probable that tankers rather than pipelines will be used to transport any oil found in the South Atlantic from the platforms to existing or future refineries. These tankers would be U.S. vessels, probably in the 16,000 to 25,000 dwt size range. Figure A-1 shows the percentage of total outflow from various polluting sources. Table A-5 shows the budget of petroleum hydrocarbons introduced into the oceans as compiled by the National Academy of Sciences (NAS, 1975). Figure A-2 illustrates the percentage and amount of oil discharged by tanker accidents by type for 1969-1970. However, tanker operations including ballast discharge, tank washing, and bilge bunkering introduce several times as much oil into the oceans that is attributable to actual accidental spills.

To alleviate this problem, both international and internal regulations have been promulgated. The Intergovernmental Maritime Consultative Organization (IMCO), a voluntary membership organization, has proposed the Load-On-Top (LOT) procedure, among many others, as the best method of eliminating the problem of oil discharge, from tanker ballasting and cleaning operations. This procedure can reduce the amount of oil introduced to the oceans by more than 50 percent. They also suggest that no discharges of contaminated water be allowed within 50 miles of a shoreline. Amendments presently proposed are even more stringent and should alleviate most of the problems related to oil pollution from tankers if they are practiced.

The effectiveness of the Load-On-Top system depends upon the length of the voyage and sea conditions enroute. It is possible that distances within the proposed sale are insufficient to allow adequate separation of oil from bilge water. Therefore, LOT may not be of much benefit in this proposal. Several solutions to the problem would be segregated ballast tanks, on board oil water separators, or reinjection of ballast water at the production site.

At the present, the methods for computing the estimated volume of oil that might be spilled or released from tankers in this South Atlantic area are quite inaccurate. One means presently available to calculate such a percentage for tankers from offshore platforms is on the basis of worldwide tanker spills versus volume of oil carried. This method however is not actually valid for the South Atlantic because: 1) relatively small size of ships would be employed 16,000 to 25,000 dead weight tons (dwt) or smaller; 2) only U.S. vessels and personnel will be used; these have better overall performance records than those of most nations; 3) worldwide spill records are compiled for some tanker operations (port-to-port, barging, lightering) that probably would not be employed in the South Atlantic; and 4) 84% of the worldwide spillage is attributed to washing tanks without using the Load-On-Top procedures. New Coast Guard regulations apply to oil concentrations of the discharge and require slop tanks. But discharge limitations can be practically met only by the LOT procedure. The statistics, however, do represent a worst case projection and are usable until more specific data with respect to size and type of tanker can be obtained (Table A-5.1). (The new CG regulations require segregated ballasts in tankers over 70,000 dwt; however, use of vessels of this size to transport any South Atlantic OCS produced oil is not anticipated due to channel restrictions at existing terminals.)

Using methods and assumptions developed for worldwide tanker spill statistics (the methodology for developing these statistics may be found in the Final EIS for Proposed Lease Sale No. 35 (Southern California), Vol. 2, pp. 50-75. It incorporates the estimated rates published by NAS (1975) as shown in Table A-5.1 the following volumes hypothetically might be spilled by tankers carrying oil from South Atlantic production sites during the 25-year field development. Estimates of oil spilled are based upon the high and low estimates of production provided by the USGS.

As mentioned previously it is assumed that tanker or barge transporation will be utilized initially to bring South Atlantic production to shore. If this were to be the case, then some kind of offshore gathering and storage failicities would be required. Since single Point Moorings (SPM's) are the most likely type of offshore oil terminals and unloading ports have historically had about one spill in every 17 vessel calls (with a significantly poorer record for loading facilities), they would represent a significant percentage of the expected oil spill incidents (U.S. Department of Transportation, 1977). However, Table A-5.1 illustrates that

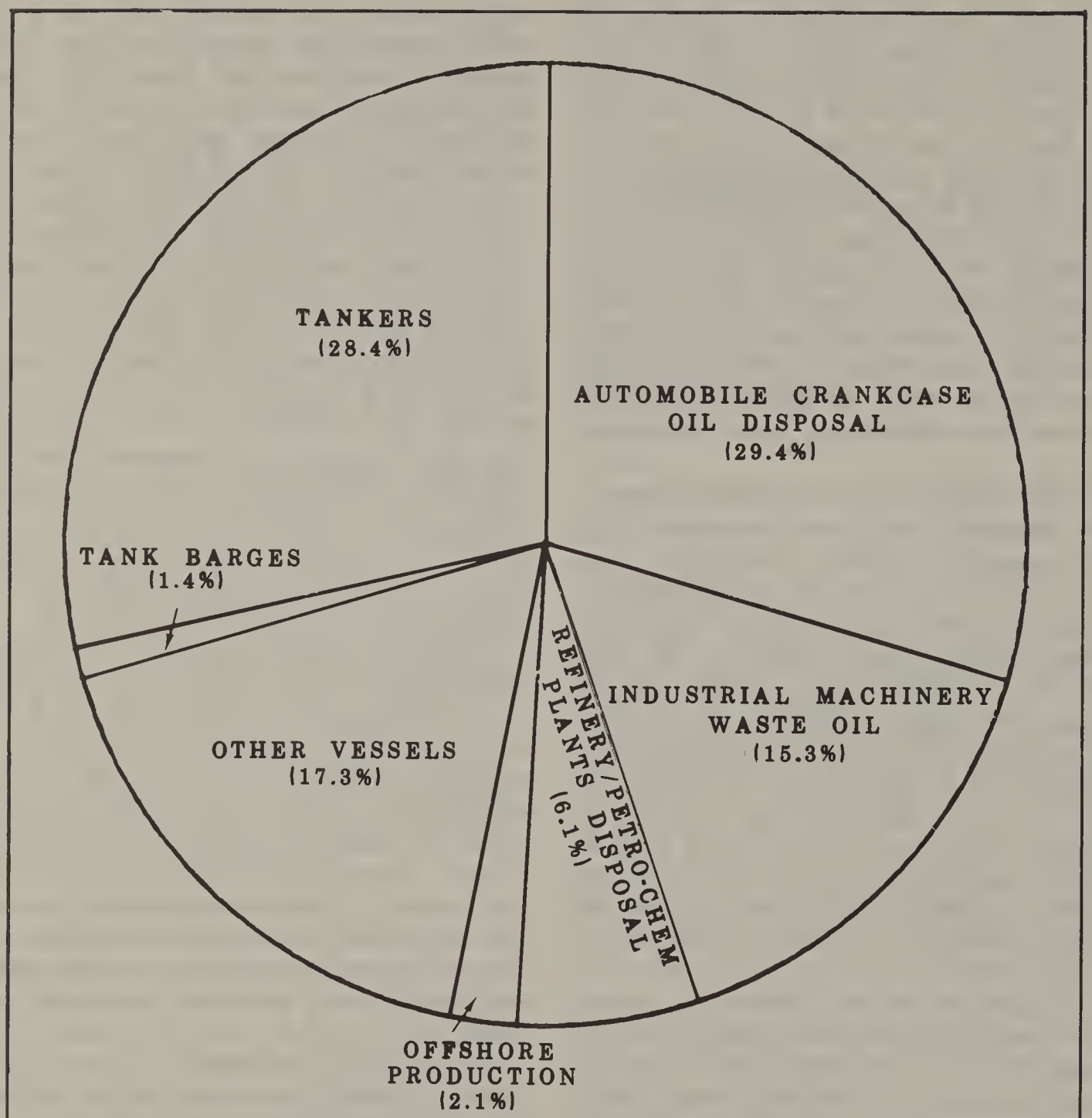


Figure A-1 Sources of Oil Pollution to the Oceans.

Source: Porricelli and Keith, 1973

TABLE A-5 Budget of Petroleum Hydrocarbons Introduced into the Oceans

Source	Input Rate (million metric tons) Best Estimate	Probable Range	Reference
Natural seeps	0.6	0.2-1.0	Wilson et al. (1973)
Offshore production	0.08	0.08-0.15	Wilson et al. (1973)
Transportation			
LOT tankers	0.31	0.15-0.4	Results of workshop
Non-LOT tankers	0.77	0.65-1.0	panel deliberations
Dry docking	0.25	0.2-0.3	
Terminal operations	0.003	0.0015-0.005	
Bilges bunkering	0.5	0.4-0.7	
Tanker accidents	0.2	0.12-0.25	
Nontanker accidents	0.1	0.02-0.15	
Coastal refineries	0.2	0.2-0.3	Brummage (1973a)
Atmosphere	0.6	0.4-0.8	Feuerstein (1973)
Coastal municipal wastes	0.3	-	Storrs (1973)
Coastal, Nonrefining, industrial wastes	0.3	-	Storrs (1973)
Urban runoff	0.3	0.1-0.5	Storrs(1973) Hallhagen
River runoff	1.6	-	
TOTAL	6.113		Storrs (1973) Hallhagen

Adapted from: National Academy of Sciences, 1975.

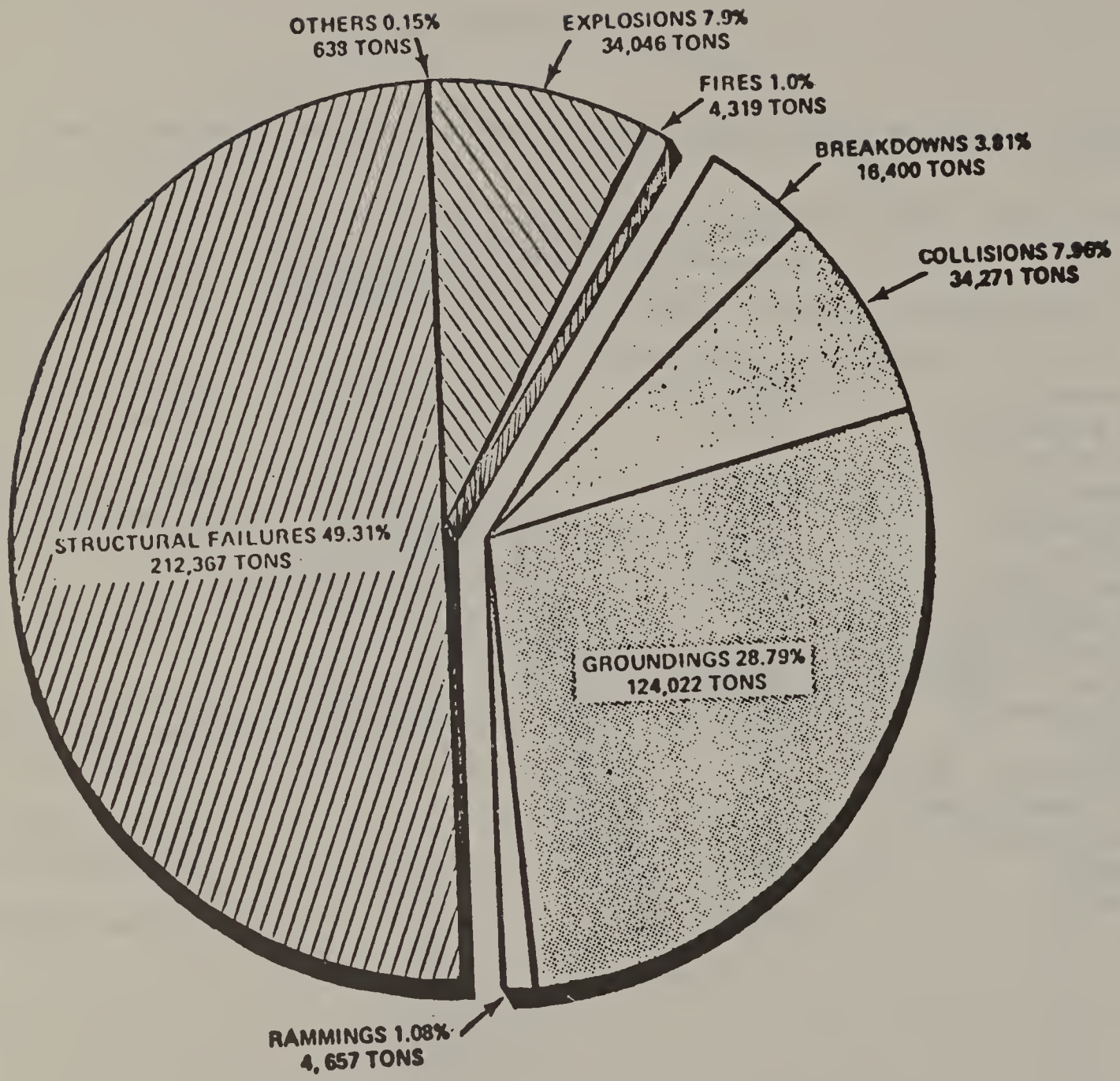


Figure A-2 1969-1970 Tanker Polluting Incidents, Percentage Oil Outflow by Type of Accident from Porricelli and Keith, 1973.

Table A-5.1 Hypothetical Tanker Oil Spillage Summary by Loss Category Over a 25-Year Field Life

Category	Rate = Vol. Spilled / Vol. Carried	Oil Spilled: Low Estimate of Production 2.82×10^8 bbls.	Oil Spilled: High Estimate of Production 1.009×10^9 bbls
Bilges, leaks and Bunkering	0.00005	14,100 bbl.	50,450 bbl.
Casualties	0.00016	45,120	161,440
Casualties Minus Structural Failures	0.00009	25,380	90,810
Terminal Operations	0.0000022	620	2,220
Dry Docking	0.000369	104,058	372,321
Tank Washing (Without LOT)	0.0035	987,000	3,531,500
Tank Washing (With LOT)	0.000352	99,264	355,168
TOTAL		1,275,542 bbl.	4,563,909 bbl.

although the frequency of incidents may be high, the ratio of volume spilled to volume carried is very low.

Portions of the Bahama Islands are located approximately 450 miles southeast of Jacksonville, Florida, and 150 miles northeast of Miami, Florida.

In the event that oil production from proposed Sale 43 was tankered to a refinery located in these islands, or tankers enroute to the Gulf of Mexico were in the vicinity of these islands, an oil spill might impact on fishing or recreation resources.

A large refinery, served by tanker imports of crude oil, is in operation in the Bahama Islands, and it is believed that the risk of environmental impact from an oil spill resulting from operations attendant from proposed Sale 43 would not be a significant additional risk.

Statistics presented by Stewart and Devanney (1976) pertaining to the relative risk of pipeline and tanker transport systems, indicate that the percent of crude oil spilled to crude oil handled is close to equal using tanker and pipeline transport. Their figures are 0.016 for tanker, 0.011 for pipeline, and 0.117 for all offshore production which includes platform and pipeline figures. Hypothesized spillage, as shown in Table A-5.1, from tanker and pipeline incidents over a 25 year period for the South Atlantic as a result of proposed Sale 43 is reached using other sources, largely the USGS, and diverges from the Stewart/Devanney estimates using a shorter time span. It is assumed that these shorter time span-based estimates are less accurate than those shown in Table A-5.1. However, they are shown in Table A-5.2.

E. NATURAL PHENOMENA

The preceeding sections dealt with estimates on the volume of oil that may be spilled annually as a result of human error and/or equipment failure. This section is devoted to oil spill probability estimates due to natural phenomena in the proposed sale area. It is taken, with minor changes, from the CEQ (1974) report which estimates the likelihood of natural phenomena damaging or destroying an offshore structure. Estimates were not based on past experiences in offshore oil operations because the environmental conditions of the U.S. South Atlantic region differ from previous experience so that estimates based on past experience have marginal value. The CEQ, therefore, used an analytical approach considering design criteria, safety specifications of the structures, and likelihood of a particular event.

Major offshore structures are designed to withstand environmental stress specified by the contracted owner or operator. Typically, forces associated with the 100-year storm have been the specified stress. There is always a chance, however that these forces could be exceeded resulting in an oil spill. For example, over a 25-year field life, the probability of at least one storm occurring with forces exceeding the 100-year storm is 26% and with forces exceeding the 200-year storm, 14%.

Based on several assumptions, the CEQ calculated the number of times oil spills can be expected to occur due to natural phenomena. It was assumed that: each severe natural occurrence is independent of the others; the probability of the occurrence is small so that the Poisson distribution applies; the probability that a natural event will occur is adequately described by the recurrence relations given in other sections of the CEQ report; structural designers can develop structures which will withstand the forces of specific natural events, and a specific natural event will occur in the vicinity of an oil field exposing the structures to the full forces associated with the event.

Unprotected wells can blow out if the platform collapses, either from excessive storm forces or earthquakes. The probability of a storm exceeding the design storm has been calculated for design specifications of both 100- and 200-year storms with safety factors of 1.5 and 2.0. It was presumed a design spectrum for earthquakes having Richter magnitudes of 6.6, 7.2, and 8.5 could be developed. The analysis further assumed that the platform would experience the full effects of a storm or earthquake exceeding the design spectrum. If a platform collapses, the conductor pipes will shear. The positive open control lines to the subsurface valve will also shear, however, thus closing the valve and preventing the loss of oil. The valves, however, are not 100% reliable and recent tests only show a 0.96 to 0.97 reliability. The CEQ used 0.96 for their calculations. A valve reliability of 0.99 was also used in order to show how improved reliability would reduce failure rates. Table A-6 summarizes the estimates.

Upon examining Table A-6, several important points are readily observed. First, the likelihood

Table A-5.2 - Summary of Differences in Tanker and Pipeline Oil Transport

	Tanker	Pipeline
Production necessary to be cost efficient:	125,000 bbl/16,000 dwt tanker 195,000 bbl/25,000 dwt tanker (20 to 30 foot draft)	70,000 BOPD/one pipeline
Needs: low estimate	2/week	1 (80 miles)
high estimate	7/week	2 (160 miles)
Landfall/Port Locations:		
Scenario D	Initially from offshore to out-of-area. In 1985 and 1988 from Jacksonville and Charleston to out-of-area.	1985 to Jacksonville 1988 to Charleston
Scenario A	Offshore to out-of-area.	None
Scenario B	Initially from offshore to out-of-area. 1985 from Jacksonville to out-of-area.	1985 to Jacksonville
Scenario C	Initially from offshore to refinery in Savannah.	1985 to Brunswick then overland pipeline to refinery in Savannah.
Scenario E	Initially from offshore to refinery in Savannah.	1985 to refinery in Savannah (includes 5 miles overland)
Transportation Routes:	It is assumed that for both tanker and pipeline transport a straight line route from point of production to the above mentioned landfalls/ports will be utilized.	
Storage Facility Needs:	generally offshore	generally onshore
*History of spills (total U.S., 1973 to 1974):		
Number of spills (Over 100 gallons)	28	343
Volume of crude handled	949×10^6	116×10^6 (all offshore production, i.e., pipelines, platforms)
Percent of oil spilled to oil handled	0.016	0.011 - pipeline only or 0.017 - pipeline & platforms
Amount of oil spilled	15,184,000 gallons (361,524 bbl)	1,276,000 gals/pipeline (630,381 bbl)/only 1,972,000 gals/pipeline & (451,714 bbl)/platform
Hypothetical Spillage in South Atlantic Region over 25 year period as a result of proposed Sale 43 (from FES III.Table A-5.1) using percent shown above	Low Est.- 4,480,000 bbl. (106,667 gals)	Pipeline only 3,080,000 bbl (73,333 gals) P/L & Platform 4,760,000 bbl. (113,333 gals)
*Stewart and Devanney (1976) letter.	High Est.- 16,000,000 bbl. (380,952 gals)	Pipeline only 11,000,000 bbl (261,905 gals) P/L & Platform 17,000,000 bbl (404,762 gals) (From FES III.Table A.4.2)

TABLE A-6. ESTIMATE OF PLATFORM COLLAPSE
AND WELL BLOWOUT (SAFETY VALVE RELIABILITY - 0.96 and 0.99)

	Age of field in years			Remarks
	20	30	40	
Severe Storm Design Standard				
100-year storm				
Margin of Safety - 1.5	.09/.0036/.0009*	.14/.0056/.0014	.19/.0076/.0019	Average number of times severe storms will cause well blowout
Margin of Safety - 2.0	.04/.0016/.0004	.07/.0028/.0007	.08/.0032/.0008	
200-year storm				
Margin of Safety - 1.5	.05/.002/.0005	.07/.0028/.0007	.09/.0036/.0009	
Margin of Safety - 2.0	.02/.0008/.0002	.03/.0012/.0003	.04/.0016/.0004	
Earthquake Design				
M = 6.6				
Atlantic M_s - 1.5	.25/.01/.0025	.38/.015/.0038	.51/.02/.0051	Average number of times earthquakes will cause well blowout
Atlantic M_s - 2.0	.23/.009/.0023	.35/.014/.0035	.46/.018/.0046	
M - 7.2				
Atlantic M_s - 1.5	.10/.004/.0010	.16/.064/.0016	.21/.008/.0021	
Altantic M_s - 2.0	.09/.0036/.0009	.14/.056/.0014	.18/.007/.0018	
Combined Severe Storm and Tsunami				
100-year storm	.001/.00004/.00001	.0015/.00006/.000015	.002/.00008/.00002	
200-year storm	.0005/.00002/.000005	.0007/.000028/.000007	.001/.00004/.00001	

*Platform Collapse/Well Blowout R = 0.96/Well Blowout R - 0.99

(Adapted from CEQ, 1974)

of platform collapse has a linear increase as the age of the field increases and a linear decrease as the design storm criteria is increased. The second important point is that platforms used in the U.S. South Atlantic OCS must be able to withstand the maximum recorded earthquake on the U.S. South Atlantic coast if the likelihood of collapse is to be no greater than that for severe storms during the field life. Table A-7 also lists the likelihood of damage caused by having a tsunami occur during a severe storm. At this point, the likelihood of oil spillage from damaged storage systems due to natural phenomena shall be examined. There are three types of storage facilities: onshore, floating and underwater. It is now required by government regulations that dikes enclose all onshore storage tanks so that, if the tank fails, the released oil will be unable to escape from the area. It is maintained by the CEQ, therefore, that the chance of an oil spill due to natural phenomena is zero provided the dikes are not damaged. Damage to dikes is very dependent on the quality of the soil foundation and, therefore, it is extremely important that a thorough geologic investigation of the proposed site be made in order to confirm that the soil properties are satisfactory.

With regard to the likelihood of natural phenomena damage to pipelines, if pipelines are properly designed, constructed, and emplaced, they are relatively insensitive to all natural phenomena except ground faulting and slumping along the pipeline routes. The possibility of soil stability loss will be assessed when a thorough geologic analysis of the possible routes has been made and a valve location program selected. These steps are taken during the late stages of the exploration program and follow the decision that the reservoir contains oil and/or gas in sufficient quantities to warrant pipeline transportation. For this reason, the likelihood of pipeline spills due to natural phenomena are difficult to predict at this time.

5. Oil Spill Trajectories in the U.S. South Atlantic Region

The introduction of offshore petroleum activities to the U.S. South Atlantic Region, as a result of this proposed sale, presents the possibility of a major oil spill occurring at some time. Oil spills on the ocean surface are usually described in terms of spreading, drifting and weathering. A combination of many factors control oil spill movement and composition. A partial list of these factors include: original composition of the oil, age, solubility, volume spilled, concentration, dilution, evaporation, photo oxidation, absorption on suspended particulates, microbial degradation, mechanical or chemical treatment, water salinity and temperature, waves, winds, currents, season and geographical location.

In order to assess the possibility of oil spills from offshore locations in the U.S. South Atlantic OCS reaching shore sites, a variety of computer simulations have been conducted. It should be remembered that two separate and distinct probabilities are involved in this type of analysis. The first is the probability of a spill occurring (which has been discussed in Section III.A.4.), and the second is the probability of a spill impacting on environmentally sensitive areas.

One of the first trajectory studies for the Atlantic OCS areas was made at the Massachusetts Institute of Technology by Stewart et al. (1974) for the Council on Environmental Quality. The study consisted of a computer simulation of the OCS environment (wind and currents) affecting movements of hypothetical oil spills. Trajectories were computed for oil spills occurring at selected locations within the Georgia Embayment. Parameters obtained from the analysis included average time to shore, minimum time to shore, and probability of the spill reaching shore. A more complete description of the M.I.T. model as well as results can be found in Appendix L.

A recently developed oil spill risk analysis model was used by the Department of the Interior to develop an analysis of probable impacts associated with OCS oil and gas development within the proposed U.S. South Atlantic lease sale area.

Utilizing available oceanographic and meteorological data in conjunction with the location of fisheries and wildlife resources, critical habitat and recreation resources specific to the U.S. South Atlantic Region, the model provides a means of (1) analyzing the probabilities of OCS-related oil spills occurring, and (2) evaluating possible drilling sites within the proposed sale area in relationship to potential impacts on the environment of the U.S. South Atlantic Region in case of an OCS oil spill. Additionally, the model determines the average time that it would take for a hypothetical spill to reach an environmentally sensitive area. This analysis could facilitate determination of further significant trade-offs for

Table A-7. Summary of the Effect of Natural Phenomena on Various Elements of the Oil Production System

Element	Natural Phenomena: Severe Storm	Earthquake Vibration	Earthquake Soil Stability	Tsunami	Volume of Oil at Risk Per Event
Platform	Slight	Slight[1/]	Slight[2/]	None	500 to 1500 bbl/ well/day
Pipeline	None	None	Variable[3/]	None	10,000 bbl or more
Onshore Storage	Slight[4/]	Slight[5/]	Slight[2/]	None	Up to 1,000,000 bbl or greater[6/]

1/ Provided earthquake resistant design features are used.

2/ Provided careful soil analysis program is followed.

3/ The avoidance of slump, faulted, or poorly consolidated sediments can reduce potential impacts.

4/ Provided tanks are sited away from flood prone areas.

5/ Provided free surface effect is reduced.

6/ Dikes give protection against damaging oil spill.

(Adapted from CEQ, 1974)

possible alternative selection of tracts that may be offered for lease. A description of the model, details of methodology, and a summary of probable risks are provided in Appendix M.

Representative spill sites were selected for analysis from within eight subdivisions of the proposed lease area (Figure A-3) based on the mean of estimated petroleum resources for individual prospects within those areas (U.S. Geological Survey, proprietary data). Use of Devanney and Stewart distributions permited separate estimates of platform, pipeline, and tanker spill frequency which could then be combined to compare the two alternative modes of transport of crude to shore. Spill frequency estimates were further categorized for spills between 50 and 100 barrels, and greater than 1000 bbls. in size. The size grouping is somewhat arbitrary but very important in considering the significance of weathering and in reducing the impact of oil spills.

Using available wind and current data, an oil spill trajectory model was constructed and used to analyze movements of hypothetical oil spills on a digital map of the area. The area might be affected was defined as the region between 28° N and 35° N latitude and about 76°20′ W longitude and the southeast Atlantic Coast.

The spatial disposition of the trajectory simulations is shown in Figure A-3. The final location of each trajectory was recorded and the results for each spill site (weighed by the estimated spill frequencies) were averaged. Thus, according to Figure A-4, 44% of the spills trajected ashore on the Florida coast, 3% on the Georgia coast, about 12% on South Carolina, and about 23% on North Carolina.

Oil spill trajectory simulations were conducted keeping track of the frequency with which trajectories intersected the locations of biological and recreational resources. Trajectories were recorded as impacting a resource only in cases where the resource was listed as being vulnerable to oil spills in the month the impact took place. Table A-8 gives the probability of impact of each of the 19 categories of biological resources and recreation areas for a spill originating at the eleven spill sites within the proposed lease area (see Figure A-3). As one would expect, the likelihood that a given spill trajectory would beach at the location of a specific land based resource during critical months is generally smaller than the 84% probability of coming ashore anywhere.

Probabilities of at least one spill greater than 1,000 bbls. occurring during the production life of the field and impacting the various groups are given in Table A-9. The probabilities have been calculated for two assumed transportation methods and two assumed transportation routes. There is a tendency for resources that occupy a large area of the shoreline or continental shelf to exhibit higher probabilities of impact. In reality the impacts of a particular spill may only affect a small portion of that resource population or habitat. Therefore Table A-9 in column 5, provides a means to compare the estimated size of the spill in relation to the exposed resource area.

A comparison of the results of these two models shows major discrepancies that cannot be explained by difference in wind and current data. The M.I.T. model results show very few trajectories impacting the Florida coast and many impacting the Savannah area. Conversely the D.O.I. model predicts impacts on the Florida coast 43% of the time and almost no trajectories hitting the Savannah area.

The D.O.I. model was essentially designed after the M.I.T. model. However much has been added concerning impacts to particular resources, sources of spills, size of spills, and probabilities of each. It should be emphasized again that neither of these models accounts for weathering, dispersion, evaporation, and other degradation factors that are important in assessing oil spill impacts. Most average times to shore in the Interior model exceeded 21 days at sea (70%). It is very doubtful that an oil spill 21 days at sea would still exist, except as very small tar balls.

6. Fate and Effects of Oil in the Marine Environment

The bulk of the following analysis was taken from Petroleum in the Marine Environment (NAS, 1975).

A. FATES

Petroleum introduced to the marine environment from whatever source goes through a variety of transformations involving physical, chemical and biological processes. This section attempts to identify major factors controlling each of these processes, to review the relevant experimental and field evidence for quantitative evaluation of the effect of these various degradation processes on petroleum, and to estimate the amount of petroleum hydrocarbons in the sea at present.

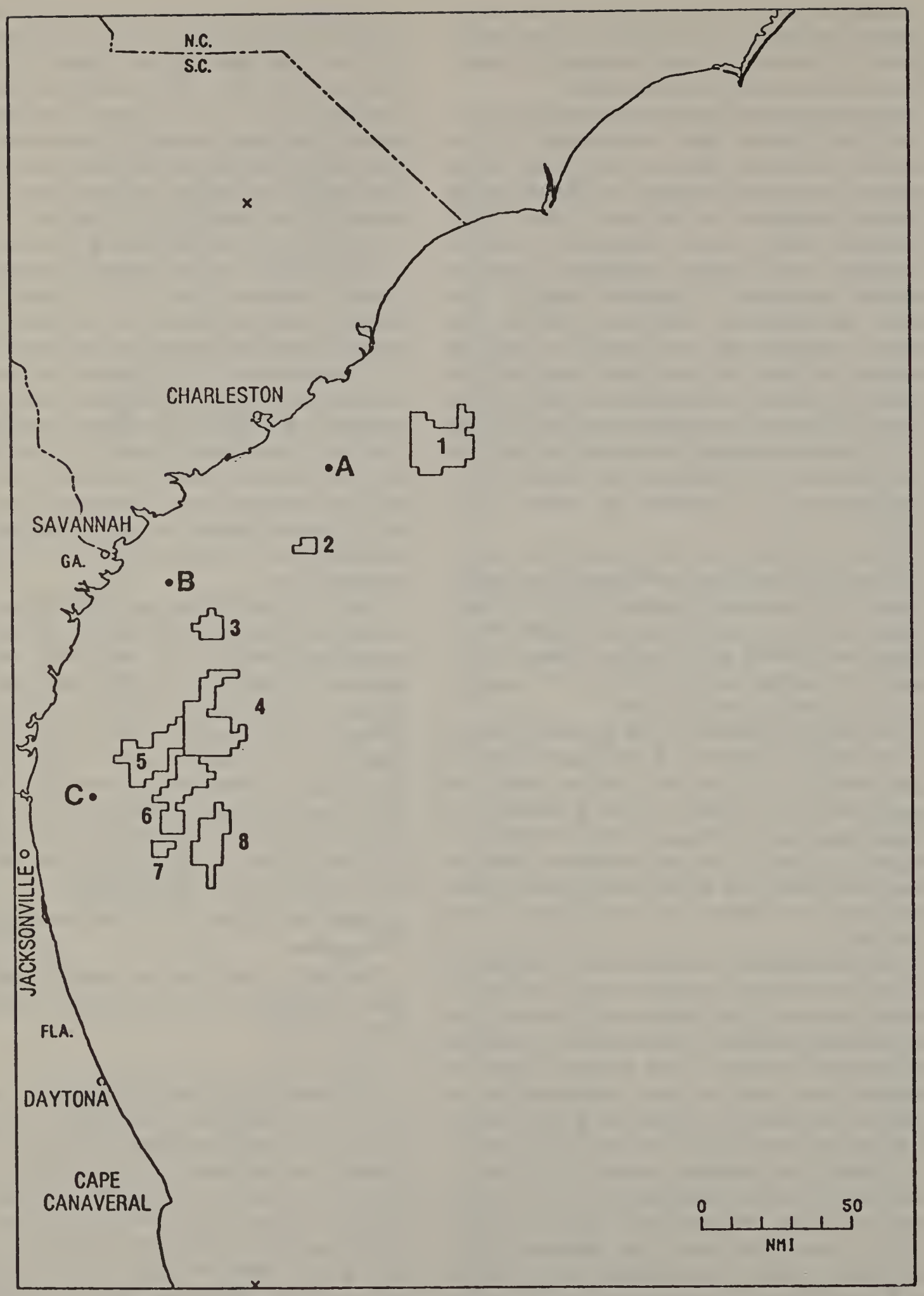


Figure A-3 Map of the South Atlantic Outer Continental Shelf showing subdivision of the proposed lease area and hypothetical transportation routes.

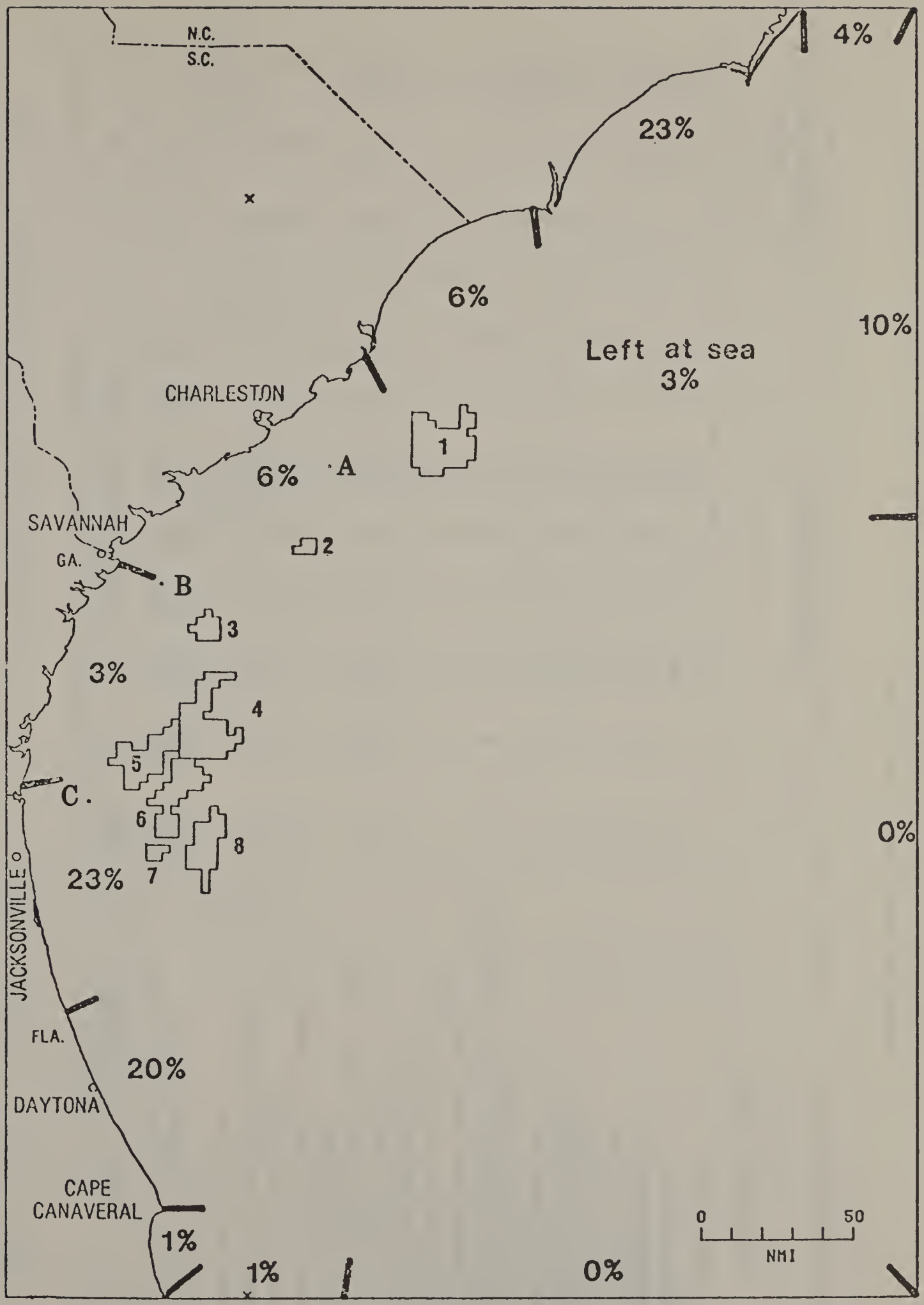


Figure A-4 -- Probability that if an oilspill occurs in the South Atlantic lease area, it will reach a particular geographic location.

Table A-8. Percent probabilities that an oil spill occurring at potential production areas in the South Atlantic lease area would impact important biological resources and recreation areas.

Resources Group	Production Area 1	2	3	4	5	6	7	8	Transportation Route A	B	C
Sandy beaches	69	73	84	84	88	89	93	90	79	86	97
Recreation areas	16	14	15	16	17	16	13	12	12	15	21
Wildlife refuges	1	2	4	2	2	2	2	2	4	4	5
Historical sites	19	17	10	11	10	10	7	7	16	6	4
Marsh and wetlands	6	7	5	4	4	4	3	4	7	8	3
Turbid water zone	19	27	28	23	26	26	27	24	32	31	30
Brown pelican rookeries	*	*	1	1	1	2	2	1	*	1	2
Coastal or pelagic bird rookeries	4	4	3	3	2	2	2	2	3	2	2
Bald eagle nesting sites	*	*	*	*	*	*	*	*	*	*	*
Dusky seaside sparrow habitat	*	*	*	*	*	*	*	*	*	*	*
Arctic peregrine falcon migration routes	57	60	73	75	77	79	83	82	63	71	88
White, brown, and pink shrimp	31	31	34	30	31	27	27	25	31	33	35
Royal red shrimp	*	*	1	1	*	1	1	2	*	*	*
Commercial fishing grounds	g	g	g	94	g	g	g	97	g	g	g
Sport fishing area	2	1	1	2	2	2	1	3	1	1	*
Commercial scallop grounds	32	22	16	19	15	15	11	13	19	8	7
Crabs and oysters	34	37	27	21	21	18	14	16	49	28	10
Bay scallops	4	3	2	2	2	1	*	*	3	1	*
Sea turtle nesting sites	35	38	40	37	39	36	34	34	40	38	37
**Rank ordering-Oil Spill Impact Risk	429	437	443	425	437	430	420	414			
Overall probability ashore	69	73	86	86	90	91	95	93	79	86	97

* Less than 0.5 percent probability

g Greater than 99.5 percent probability - scored as 100% probability for the purposes of rank ordering (≤ % probability)

** Obtained by combining percent probabilities in each resource category (assuming equal weight or value for each resource). The higher the total, the greater the risk anticipated.

TABLE A-9 Probabilities of one or more spills greater than 1,000 bbls occurring and impacting biological resources and recreational areas in the South Atlantic area over the production life of the entire lease area. Also, the size of a major spill in relation to the extent of exposed resource.

	Probability (percent)				
	Based on pipeline transport to Jacksonville and Savannah	Based on pipeline transport to Charleston and Savannah	Based on tanker transport to Jacksonville and Savannah	Based on tanker transport to Charleston and Savannah	Ratio of mean spill size to extent of exposed resources‡
Probability of coming ashore	93	92	96	95	.04
Beaches	93	92	95	95	.05
Recreation areas (State and Federal)	40	39	45	43	.24
Wildlife refuges	8	8	9	9	.53
Historical sites	29	32	33	33	1.0
Marsh and wetlands	15	16	17	14	.10
Areas of high sedimentation rate	55	55	61	62	.12
Brown pelican rookeries	3	2	4	3	3.33
Coastal or pelagic bird rookeries	8	8	9	9	.37
Bald eagle nesting sites	*	*	*	*	10.00
Dusky seaside sparrow habitat	*	*	*	*	25.00
Arctic peregrine falcon migration routes	89	89	93	93	.04
White, brown, and pink shrimp	62	62	69	69	.07
Royal red shrimp	2	2	2	2	2.5
Commercial fishing grounds	95	95	97	97	.02
Sport fishing area	4	5	5	5	.71
Commercial scallop grounds	43	44	47	49	.22
Crabs and oysters	53	58	59	65	.06
Bay scallops	6	7	7	7	.53
Sea turtle nesting sites	69	69	75	75	.05

* Less than 0.5 percent.

‡ Onshore resources compared on the basis of length and offshore resources on the offshore resources on the basis of area (see Appendix M).

Physical and chemical processes begin to operate immediately when petroleum is spilled at the ocean surface. These include evaporation, spreading, emulsification, solution, sea-air interchange and sedimentation. Involved in all these "physical" processes are chemical factors determined by the composition of the petroleum fraction. In addition, purely chemical oxidation of some of the components of petroleum can be induced by sunlight. The products of these processes include hydrocarbon fractions introduced to the atmosphere, slicks and tar lumps on the surface of the ocean, dissolved and particulate hydrocarbon materials in the water column, and adsorbed or particulate hydrocarbons materials in the sediments.

At the same time physical and chemical separation and degradation processes are occurring, biological processes also act on these various fractions of the original petroleum in various ways. The biological processes include degradation by microorganisms to carbon dioxide or organic materials in intermediate oxidation stages, uptake by larger organisms and subsequent metabolism, storage, or discharge. The natural forces acting on oil spilled at sea are shown in Figure A- 5.

(1) Physio-chemical Fate

The NAS workshop concluded the following with regard to the physical and chemical fate of oil in marine systems:

(a) Slicks and tar lumps are transient conditions and do not represent the ultimate fate of petroleum spilled on the sea.

(b) The ultimate fate is one of the following: evaporation and decomposition in the atmosphere, dispersal in the water column, incorporation into sediments, oxidation by chemical or geological means to CO_2.

(c) The standing crop of petroleum-like material in the form of slicks and floating lumps is of the order of a year's input. Tar stranded on rocky shores may have a much longer lifetime.

(d) Crude oil and some petroleum products transported by sea can easily form tar. Occurrence of pelagic tar correlates with intensity of tanker traffic in different regions of the ocean.

(2) Biological Fate

The NAS workshop concluded the following with regard to the biological fate of oil in marine systems:

(a) Neither a single rate nor a mathematical model for the rate of petroleum biodegradation in the marine environment can be given at present. On the basis of available information, the most that can be stated is that some microorganisms capable of oxidizing chemicals present in petroleum (under the right conditions) have been found in virtually all parts of the marine environment examined.

(b) Laboratory experiments have demonstrated that the n-alkane fraction of petroleum is most easily degraded. In toxic marine environments, this type of compound is likely to be degraded in a matter of days or months, depending principally on temperature and nutrient supply. Other fractions are more resistant to microbial action, and the time required for substantial decomposition of the most resistant components of petroleum in the marine environment is probably measured in years to decades.

(c) In larger organisms, hydrocarbons are taken up primarily through the gills or by ingestion of particulate matter. Direct uptake from water through the gills is probably the most important pathway in pelagic environments. For benthic organisms, the sediments may be a more important source.

(d) The measured level of petroleum hydrocarbons (after correction for biogenic contributions) in a variety of marine organisms ranges over three orders of magnitude (1 ug/g to 400 ug/g wet weight).

(e) Some organisms (e.g., copepods) can ingest large quantities of petroleum and eliminate it directly as fecal matter without substantial degradation.

(f) Some fish and crustaceans metabolize petroleum hydrocarbons within two weeks; in plankton and benthic invertebrates, however, metabolism is slow and the pathways are poorly understood.

(g) Storage of hydrocarbons, including those from petroleum, occurs in the lipids of many organisms. Biogenic hydrocarbons, particularly di- and triolefins, are often clearly distinguishable from petroleum.

(h) Some organisms (e.g., mussles and oysters) can eliminate most petroleum hydrocarbons (but not all) after absorption if placed in unpolluted water.

(i) Discharge by vertebrates occurs primarily through the gall bladder and kidney. Paths of

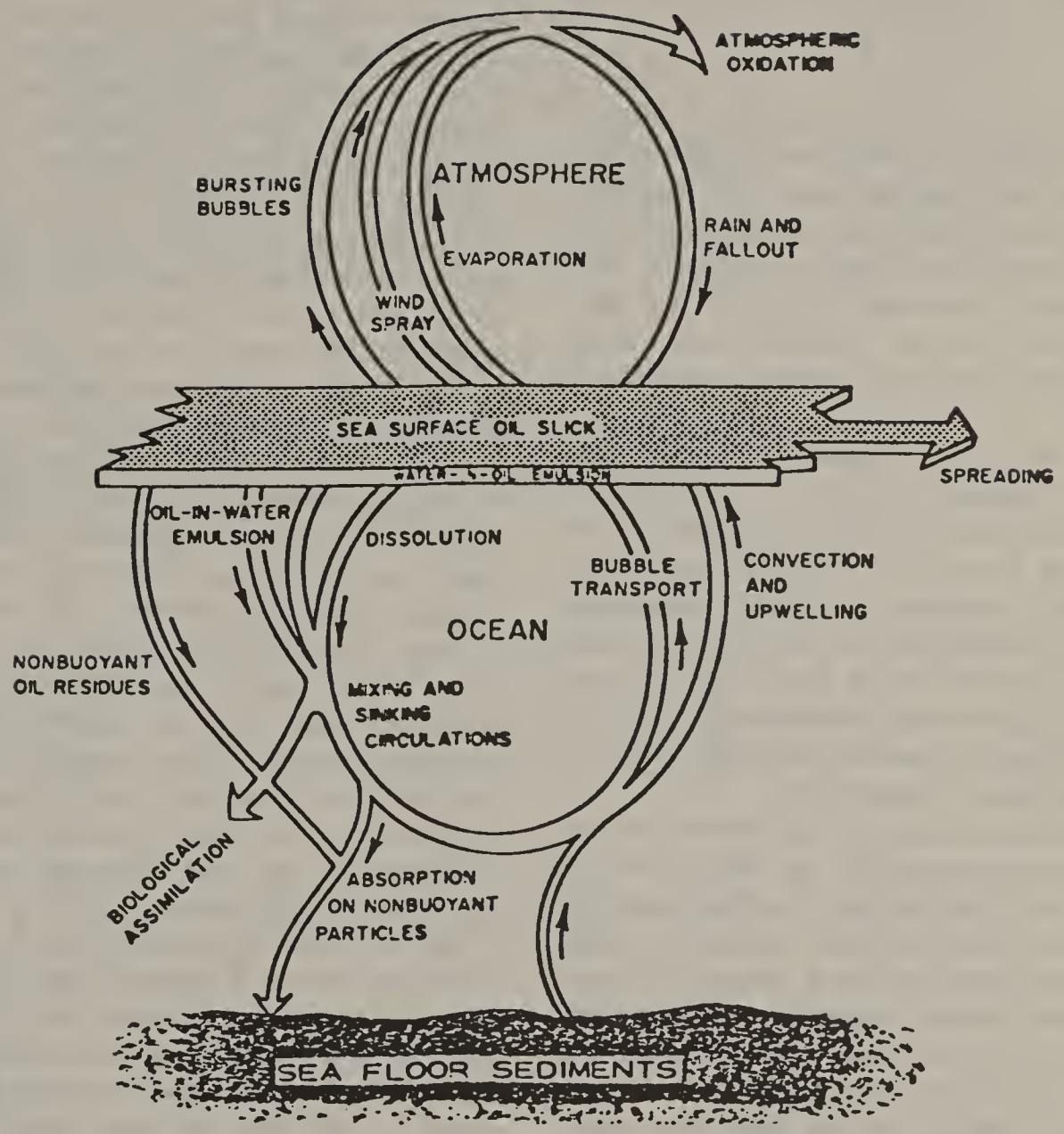


Figure A-5 Natural Forces Which Disperse and Modify Petroleum Slicks on Water (Adapted from Garrett, 1972)

discharge for invertebrates are not well established.

(j) There is no evidence for food web magnification in the case of petroleum hydrocarbons in the marine environment. On the contrary, evidence is strongest that direct uptake from the water or sediments is more important than from the food chain. A discussion of impacts on food webs is found in Appendix I.

B. Effects

Table A-10 shows that a limited number of documented studies exist that consider the biological, chemical and physical acute and long-term effects of oil in the marine environment. Because most studies have been made in estuaries, little data are available concerning effects on the open ocean. However, certain generalizations about various aspects of oil in the marine environment can be made.

Whereas the concentration of petroleum hydrocarbons dissolved in water is generally low (<10 ppb) it was found to be much higher in sediments, ranging from 1,500 to 5,700 ppm in polluted coastal sediments (natural indigenous hydrocarbons in sediments in nearby unpolluted areas ranged from 26 to 130 ppm). On the outer coastal shelf, concentration in sediments might be as high as 20 ppm, whereas in the deep ocean 1-4 ppm was the usual concentration.

In general, where damage was severe, the oil spill was massive relative to the size of the affected area, and the spill was confined naturally or artificially to a limited area of relatively shallow water (less that 6 m) for a period of several days. Deletrious effects may have been increased by storms or heavy surf water mixed with oil and sediments in the affected area. These effects were also generally localized, ranging from a few miles to tens of miles, depending on ecological and environmental circumstances; however, for a given quantity of oil, the more localized the distribution of the spill, the greater is the mortality.

Different oils were found to have different effects, with toxicity being most pronounced for refined distillates and physical smothering most severe with viscous crude oils or Bunker C crude oil. Refined No. 2 fuel oil was among the oils having the most toxic effect. Variations in physical environment in coastal areas were also considered in determining effects, i.e., a polluted area might experience sudden and unpredictable stresses from synergistic interactions between variable environmental factors and the oil.

The amount of oil and the type of organisms afflicted was also found to be important. For example, a single coating of fresh or weathered crude oil or its derivatives on certain bird species or on seed of plants caused death, whereas marsh plants were killed only after several coatings. In general, emergent plant life was less likely to be affected than marine biota, unless the spill occurred in tropical waters where mangroves were present. Very low concentrations of the soluble fractions of kerosene interfered with searching behavior of a marine snail. Crude oil on the shells of oysters had no effects. The photosynthesis of marine phytoplankton was reported to be reduced by 100 ppb of No. 2 fuel oil. Mortality of some organisms has been found in all major spills for which studies have been published, with the pelagic diving birds being the most obvious casualties. The extent of the mortality depended on local conditions and was greatest when the releases of oil were confined to inshore areas where natural marine resources were abundant. Intertidal organisms tended to be more resistant to stress than subtidal species. In one instance, where the herbivores were reduced, the intertidal plants on which they fed increased markedly. In laboratory studies where organisms were near their limits of tolerance to temperature or salinity, pollution products caused a much greater change in metabolic rates than when the physical conditions were nearer optimum.

The recovery of polluted areas varies greatly, depending on the flushing of the polluted areas, the type of the sediments on the substrata, and the degree of isolation of its ecosystems and the kinds of organisms that form them. The time period for recovery may vary from a few months to several years. In general, the initial stages of recovery are characterized by opportunistic species that are often very productive, with a much longer time required to restore the community to one that supports more long-lived species.

One characteristic of organisms composing an ecological community that may affect its stability and rate of recovery is, for example, a slow rate of reproduction or growth. Such a characteristic increases the vulnerability of a species or ecological community to damage from oil or any other pollution. Marine birds in the planning area may have similar responses.

TABLE A-10 A Summary of Several Major Oil Spills Followed by Studies of Their Biological Impact

Date of Spill	Source and Location	Type and Amount of Oil(barrels)	Shoreline Affected (mi)	Localities Studied	Species Identified	Sampling Method	Biological Damage	Reference
March 1957	Tampico Maru, Baja California,Mexico	Diesel oil 60,000	2	Intertidal & subtidal	Larger visible plants and animals	Qualitative,quantitative macrocystis counts	Nearly total devastation immediately,luxuriant growth of seaweed developed within months; biota 90% restored after 3 or 4 years, although relative abundance of certain species still somewhat changed after 12 years	North et al., 1964;Mitchell et al., 1970
July 1962	Argea Prima, Guayanilla Harbor, Puerto Rico	Crude oil 70,000		Mangrove shores; intertidal and subtidal	Blue-green algae	Qualitative	Extensive damage:high mortalities among many shallow water and shore-dwelling organisms,including a wide variety of vertebrates; also extensive damage to intertidal and sublittoral algae and mangrove habitat	Diaz-Piferrer, 1962
Jan. 1967	Chryssi P. Goulandris, Milford Haven England	Crude oil 1,800		Intertidal salt marsh; intertidal rocky shore	Grasses	Semiquantitative rocky shore transect;quantitative studies of grasses	Most damage to intertidal organisms;gastropod molluscs badly affected, also barnacles and sea anemones on a number of shores; no apparent damage to algae	Cowell,1969; Nelson-Smith, 1968
March 1967	Torrey Canyon, S.W. England	860,000		Intertidal rocky shores and sand beach	Larger visible animals only	Semiquantitative rocky shore transects;qualitative beach and subtidal surveys; quantitative algal counts	Very high mortalities of intertidal shore life,mostly due to use of toxic emulsifiers;many invertebrates and algae killed on shores; fisheries and plankton apparently unaffected;estimated 10,000 birds killed	Bellamy et al., 1967;Smith, 1968
Sept. 1967	R.C. Stoner, Wake Island	Aviation gas, J-P4 jet fuel, A-1 turbine oil, and Bunker C oil 126,000		Intertidal & subtidal	Large visible invertebrates	Qualitative	Many dead fish stranded on shores; also abundant dead molluscs,sea-urchins, and crabs	Gooding, 1968
March 1968	Ocean Eagle, San Juan Harbor, Puerto Rico	Crude oil 83,000		Intertidal rocky shore	15 large sp.	Qualitative	Many subtidal and intertidal organisms killed or damaged by oil or oil and emulsified, including molluscs,crustaceans,and algae,although subsequent recovery good; 10 species of fish found dead or in state of stress	Cerame-Vivas, 1968

TABLE A-10 (continued)

April 1968	Esso Essen, S. Africa	Crude oil 20,000-28,000		Intertidal & subtidal	No species identifications, observations on larger organisms	Qualitative	High mortalities of sandhoppers (amphipods) but otherwise little damage on shores; high bird mortalities	Stander and Ventner, 1968
Dec. 1968	Witwater, Galeta Island, Canal Zone	Diesel and Bunker C oil 20,000		Rocky intertidal coral reef, sandy intertidal mangroves	Uca, mangrove species, four coral species	One quantitative sand sample for meiofauna; otherwise qualitative	On rocky shores, extensive mortality of supralittoral vegetation and tide pool life; on sandy beaches, great population decreases among meiofauna, especially crustaceans; many young mangroves killed in swamp areas, also algae and many invertebrates; coral reefs apparently unharmed	Rutzler and Sterrer, 1970
Jan. 1969	Well A-21, Santa Barbara Channel	Crude oil 33,000	40	Intertidal & subtidal	Subtidally: selected polychaete families, ophiuroids, and molluscs not including smaller polychaetes and amphipods; intertidally: visible rocky shore species and 195 sp. retained by 1.5mm screens in sandy areas	Grab sample, qualitative at species level; quantitative for biomass line transects on rocky shores; 1/100 m^3 samples on beaches	High mortalities of intertidal organisms covered with oil; about 3,600 birds killed; no apparent effects on fish and plankton; no directly attributable damaging effects of oil on large marine mammals or on benthic fauna; area recovering will within a year	Cimberg et al 1973; Fauchald, 1971; Foster et al, 1971a,b; Nicholson and Cimberg, 1971; Straughan, 1972
Sept. 1969	Florida, West Falmouth, Mass.	No. 2 fuel oil 4,500	3	Intertidal mud and sand flats; subtidal to 10 mm	All animals 0.247mm, excluding nematodes, copepods; ostracods and unicellular organisms, including smaller polychaetes and amphipods	Quantitative transects	Severe pollution of sublittoral zone, with 95% kill of all fauna, including many fish, worms, molluscs, crabs, lobsters, and other crustaceans and invertebrates; local shellfish industry severely affected; Wild Harbor still closed to shellfish fishing in May 1974	Blumer and Sass, 1972; Blumer et al., 1970a,b
Feb. 1970	Arrow, Chedabucto Bay	Bunker C 108,000	12	Intertidal rocky shore; intertidal lagoon	Common visible species on rocky shore and species 74 mm in lagoon samples	Semiquantitative transects; 2 samples in lagoon	Localized damage to intertidal life, where most mortalities were crabs, limpets, and algae, probably killed by smothering; local fish catches normal; about 2,300 birds killed; 5 months after spill, subtidal flora and fauna healthy; fishing and lobstering normal	Thomas, 1973; Navships, 1970
Jan. 1971	Arizona Standard and Oregan Standard, San Francisco Bay	Bunker C 20,000	60	Intertidal & subtidal rocky shore; intertidal sand beach	31 larger sp.	Quantitative transect counts	Some damage to shore life, mainly to acron barnacles, limpets, mussels, and striped shore crabs; 3,600 birds killed; area nearly normal within 1 year	Chan, 1973

TABLE A-10 (continued)

Feb. 1971	Wafra,Cape Aulhas, S.Africa	Crude oil 445,000	10 -	Intertidal rocky shores	Larger intertidal rocky shore species	Qualitative	Little damage to intertidal life; 1,135 black footed penguins found oiled	Day et al., 1971
April 1971	March Point Dock Facility, Anacortes, Washington	No. 2 fuel oil 5,000	20	Intertidal beaches, rocky shores, subtidal	Animals 4mm in subtidal samples, visible fauna identified to major taxa only	Quantitative grabs;quantitative intertidal transects	Some oil on shores,damaging shellfish,limpets,crabs,clams and oysters;about 1,000 birds involved	Watson et al., 1971;Woodin et al., 1973
Jan. 1972	General M.C. Meigs,Wreck Cove,Washington Coast	Navy special oil 3,000	300-500 yd	Intertidal rocky shores	37 sp. algae,sp. animals not including smaller polychaetes and amphipods	Quantitative transects	Urchins affected;plant community showed less of fronds and bleached thalli	Clark et al., 1973

Source: NAS, 1975.

Some aquatic species that live only in brackish regions of estuaries have planktonic larvae. If these drifted passively in the current, they would be washed out into the open sea and lost; instead, they dive deeper after drifting toward the mouth of the estuary and are carried by the deeper currents back up to where they were spawned in the brackish regions. Thus, if the estuary is an isolated one, almost all the recruitment of these organisms is from the offspring of the resident population. If this population were completely destroyed by pollution, recolonization by chance immigration from a distant estuary would probably take a very long time. The resident population of estuaries provides shelter and food for the young stages of many commercially important marine organisms (shrimp, fish, etc.).

There is very little data on the effect of oil on pelagic species. Without more research, it is clearly premature to conclude anything about the effects of oil on the open ocean.

The information base with regard to the effects of oil in the marine environment on human health is extremely limited. However, certain observations have been made:

1. Compounds with carcinogenic properties are among the hydrocarbon compounds released into the environment.
2. Direct uptake by marine organisms of these compounds can occur.
3. Hydrocarbons are stored in the lipids of marine organisms.
4. Organisms capable of storing hydrocarbon are common human dietary items.
5. Hydrocarbon uptake from marine organisms by man is possible.
6. The quantities accumulated from this source are probably low.
7. The significance of this uptake as related to carcinogenesis is unknown.

Based on this limited information, the National Academy of Sciences (1975) tentatively concluded that modest concern rather than alarm appears to be justified. Although it is known that petroleum contains small amounts of carcinogens and possibly small amounts of other harmful materials, the amounts of carcinogens known to be in petroleum that could be ingested by eating marine organisms is estimated (NAS, 1975) to be no greater than that acquired from eating any other foods.

7. Other Factors Influencing Oil and Gas Operations

This section will discuss the estimated range of facilities and employment anticipated to result from this proposal. The discussion will include those estimates based on the Geological Survey information relative to the estimated recoverable resources on the 225 tracts comprising approximately 518,400 hectares (1,280,966 acres) included in the notice for proposed OCS Sale No. 43 dated April 27, 1976 (Appendix B).

Section III.E. discusses some of the possible onshore impacts of these OCS-related facilities and activities as well as analyze induced activities and their effects on the human and natural environment. Because it is not possible to indicate with any certainty the future locations of facilities which may result from this proposal, a generic approach has been taken for purposes of this analysis.

In order to provide a framework for other subsections, this section will briefly discuss the nature of OCS-related facilities. Factors affecting the timing and distribution will be addressed. In addition, these factors will be applied to indicate general locations that may be affected by OCS development.

A. RESOURCE ESTIMATES (OIL AND GAS)

The Geological Survey has provided estimates of recoverable resources that may be found in the tracts offered for lease during proposed OCS Sale No. 43:

	Low	High	Mean
Oil (Billions of barrels)	0.282	1.009	0.65
Gas (Trillions of cubic feet)	1.890	6.810	4.30

The Geological Survey noted that these estimates included several assumptions and also noted that a zero lower limit for resource estimates did exist.

B. RANGE OF FACILITIES

Listed in Table D-1 (Section I) is the estimated range of major facilities anticipated to be required as a result of the proposed sale as provided by the Geological Survey (1976).

C. REFINERIES

Refineries have not been included as facilities necessitated or stimulated by this proposed sale.

The future demand for domestic refining capacity in the U.S. South Atlantic region cannot be determined with any certainty. There are indications of excess refining capacity nationwide. According to Business Week, January 12, 1976, the two-year decline in demand, coupled with market conditions and high prices, has left U.S. refiners considering how existing capacity should be utilized rather than planning for expansions. Existing capacity has been increasing at an average rate of seven percent in recent years, according to the article. However, most increases were achieved through expansions or improvements of existing facilities. For example, the Oil and Gas Journal, in its annual refining survey (April, 1974), indicated a 6.3% capacity gain in 1973. Practically every case, it reported, was due solely or in large part to debottlenecking.

Another factor to be taken into account when considering links between OCS production and refining is the source of crude oil for a domestic refinery. An article in the New Orleans Times-Picayune, August 31, 1976, described the new Energy Company of Louisiana (ECOL), Ltd. refinery at Garyville, Louisiana, as a 200,000 barrel-a-day refinery built to produce fuel oil. The article described the refinery as the largest ever built in a single construction phase in the continental United States and is also the largest independent refinery in the U.S. The article appeared on the occasion of the first delivery of imported crude oil to the ECOL refinery.

Within the U.S. Mid-Atlantic region, Mobil cancelled its plans for a new refinery at Paulsboro, New Jersey. The major reasons cited were inflation and a decrease in demand (Oil and Gas Journal, January 11, 1974). Amerada Hess closed down its 65,000 barrel/day refinery at Port Reading, New Jersey, in November, 1974. The refinery could be brought back on stream within about a month if conditions warranted, according to the company (Oil and Gas Journal, October 28, 1974).

Refinery capacity in the U.S. Mid-Atlantic coastal area as of January, 1976, was 1,427,800 barrels per calendar day. Planned expansion to these refineries are expected to add another 110,000 barrels per day by the end of 1976. In addition, new proposed refineries in the Baltimore, Maryland, and Hampton Roads, Virginia, areas could add an additional 384,100 barrels per day capacity (Oil and Gas Journal, April 26, 1974).

Crude oil production as a result of this sale may amount to between 56,000 to 170,000 barrels per day, and this volume of production by itself does not appear to warrant the construction of a refinery.

Operating refining capacity is present in the northern half of the Atlantic seaboard, in the Gulf of Mexico area, and on the islands of the Caribbean Sea, according to Bureau of Mines publications and other data. A selected list of refineries is included in Table J-16.1 (Section II.J).

Although refineries have been proposed for construction in the southeastern United States, information available to the New Orleans OCS Office indicated that no concrete proposals are under consideration at the present time.

For the purpose of developing some concept of the total effect that might result from refinery processing as well as exploration and production activities, some hypothetical scenarios have been included with a refinery located in Chatham County, Georgia. The rationale for this choice was based on the possibility that future increased demand in the four-state area might initiate the construction of a refinery; the area selected was centrally located relative to the sale area, and contained a developed port.

Another location for a refinery was postulated in adjacent Jasper County, South Carolina. In both cases, the refinery would be near the Port of Savannah and, hypothetically would be built with or without oil production on the Outer Continental shelf. The reason for hypothesizing a second location for the possible refinery was to consider the impacts if a refinery with its accompanying tax revenues was located in one state while most of the workers and their associated housing and social costs (such as education and police protection) were located in another state. (For further discussion, see Appendix K.)

Future developments such as more refined estimates of demand, the location of production (rather than proposed sale area), or the availability of an offshore crude oil facility would be factors that would possibly indicate a site in other areas.

One example that lends some credence to the proposition that crude oil produced in the area does not necessarily lead to the construction of a refinery is contained in the history of the crude oil production in south Florida. Oil produced from fields located in southwest Florida is transported

by pipeline to a terminal on the eastern coast of Florida and is shipped to refineries located in other areas.

The principal effect of crude oil production from this proposed sale would probably be to displace a volume of imported crude oil processed in an existing domestic refinery.

D. FACTORS ASSOCIATED WITH OCS-RELATED FACILITIES AND GENERALIZED POTENTIAL LOCATIONS

Table A-11 lists primary OCS-related facilities indicated previously plus additional, smaller facilities and approximate employment and investments associated with each.

The timing of investments in OCS-related facilities and resulting employment levels occurring as a result of the proposed sale, depend on the success of initial operations. Exploratory drilling is expected to commence within one year of the proposed sale date and could continue for 14 to 16 years. The peak exploratory activity would occur in the initial five years following the proposed sale. Existing port facilities are expected to be utilized in the early years as staging and supply bases to support these activities.

Information provided by the American Petroleum Institute (API) Production Subcommittee and the Offshore Operators Executive Subcommittee (1976) concerning estimated employment and facility needs for operations on the outer continental shelf indicate that support facilities require inland water dock facilities with access to the Atlantic Ocean, land zoned for industrial uses, facilities for helicopter transportation, access to road and rail transportation, and rental office space. In addition to these requirements, living accommodations would be required for the employed personnel.

Several areas provide sites for facilities that meet these requirements. For the purpose of estimating the impacts that may result from this proposed sale, specific points had to be designated as the locations of onshore support bases. In some of the hypothetical cases, an onshore support base was assumed to be established in Chatham County, Georgia. In other cases, support bases were assumed to be located in Glynn County, Georgia; Charleston County, South Carolina; and Duval County, Florida. These locations were chosen to provide a range of areas and degrees of industrial activity and are not firm predictions that support facilities will most probably locate in these areas. Some additional factors that might be considered in the establishment of an operations base include the identity of the successful bidder for particular tracts, the contractor who would drill the exploratory wells, and the availability of suitable space and facilities for sale or rental.

Mr. R. J. Robicheaux of Otis Engineering Corporation provided testimony at a BLM hearing held in Mobile, Alabama on September 23-24, 1975, concerning the onshore impacts that resulted from the exploratory drilling in the eastern portion of the Gulf of Mexico that resulted from the MAFLA (Mississippi, Alabama, and Florida) OCS Sale of December, 1973. The operating points for the oil companies were Port Manatee, Panama City, and Pensacola, Florida, and Dauphin Island, Alabama. The largest amount of land area required was approximately 3.61 ha (9 ac) and the total used in the four areas was approximately 6 ha (15 ac). The total employment presented in this testimony amounted to 83 persons, 39 hired in the local community, and 44 transferred into the communities. An additional factor which should be considered in utilizing this information was the relatively short distance from these bases to existing supply depots established to support operations in the central Gulf of Mexico.

While specific site locational constraints of onshore operations bases, from which rigs and platforms are supplied and serviced, are known, it is not known what the specific transportation and other costs would be. Minimizing the cost of shipping goods and services to where they are needed will be a factor in locating the operations bases. Therefore, the distance between the bases and the operating area (proposed sale area) must be considered. Minimizing transportation costs of obtaining goods and services would also be a factor, so that access to larger metropolitan areas would be a consideration. While other costs (costs of labor, land acquisition, and possibly those stemming from conditions placed upon the project in meeting regulatory standards) could outweigh transportation costs, the latter are considered more important.

Table A-12 indicates industry estimates of expected types of service support facilities which could be required in addition to operations bases. The amount of activity necessary to establish each in the region is also indicated.

Estimated Employment, Space, and Location Requirements

INDUSTRY INPUT TO BLM PROPOSED OCS LEASE SALE NO. 43

SOUTH ATLANTIC REGION

TABLE A-11

Support Facilities and Employee Types	Per Rig Operation	Per Platform Operation	Per Unit of Production	Total Number of Employees	Avg. Wages $/Month	Total Wages $/Month	Employees Hired Locally	Employees Maintaining Local Residence	Area Requirements In Acres	Capital Investment 1974 - $	Character of Space	Special Factors	Comments
Exploratory Rig	1 Rig												Exploratory rigs can be either the jack-up, semi-submersible, or floater type.
Contract Rig Crew	"			72(7/7)	1,100	79,200	26	49					
Dockside Support	"			6(5/2)	800	4,800	6	6					
Service Support	"			11(7/7)	1,425	15,675	0	9					Rig Crews - Pusher, Driller, Derrickman, Motorman, etc. type. Also includes catering.
Co. Supervision	"			4(7/7)	1,850	7,400	0	3					
Transportation													
Air	"			4(7/7)	1,500	6,000	2	4					Service Support - Mud Man, Cementing, Logging, etc. type.
Marine	"			16(7/7)	750	12,000	8	16					Air - Pilots, Mechanics. Marine - Standby & Supply Boat Crews
Development Rig	1 Rig												Development rigs are self-contained platform type.
Contract Rig Crew	"			52(7/7)	1,100	57,200	26	52					
Dockside Support	"			2(5/2)	800	1,600	2	2					
Service Support	"			8(7/7)	1,550	12,400	0	8					Rig Crews - Similar to exploratory, but less in number.
Co. Supervision	"			3(7/7)	1,850	5,550	0	3					
													Service Support - Similar to exploratory, but includes directional drilling and completion type people.
Platform Production Operations		1 Plat.											This operation assumes optimum platform utilization to develop large reserves centrally located.
Co. Employees		"											
Pumper-Operator		"		4(7/7)	1,300	5,200	4	4					Refer to assumption sheet for production estimates per platform.
Mechanic		"		2(7/7)	1,400	2,800	2						
Electrician		"		1(7/7)	1,400	1,400	1	1					Remedial Crew - Includes workover rig, wireline, and service technician type.
Technician		"		1(7/7)	1,300	1,300	1	1					
Roustabout		"		4(7/7)	1,200	4,800	4	4					
Supervisor		"		2(7/7)	1,800	3,600	0	2					
Contract Employees		"											
Welder & Helper		"		1(7/7)	1,000	1,000	1	1					
Paint Crew		"		1(7/7)	800	800	1	1					
Roustabout		"		2(7/7)	650	1,300	2	2					
Remedial Crew		"		2(7/7)	1,200	2,400	2	2					
Caterers		"		2(7/7)	650	1,300	2	2					
Onshore Operations Base		200,000 BOPD							50	2,800,000	Industrial Zoning	Inland water dockside location with Atlantic Ocean Access Atlantic Shoreline not necessary	This type installation is designed to service the offshore drilling and production.
Co. Employees		"		8(5/2)	1,400	11,200	4	8					Co. Employees - Administrative type.
Contract Employees													Air - Pilots, Mechanics.
Air		"		27(5/2)	1,525	41,175	20	27					3 - Large helicopters
Marine		"		76(7/7)	800	60,800	62	76					4 - Small helicopters
Service Support		"		25	800	20,000	25	25					Marine - Boat Crews
													4 - Crew Boats
													3 - Cargo
													2 - Tugs
													Development of this region may require 3-5 of these type bases.
Onshore Office		200,000 BOPD							10,000 Sq. Ft.	Rental	Office Business Zoned	Metropolitan Area	Assumes office space available but may generate new office building construction.
Co. Employees		"											
Supervision		"		8(5/2)	2,200	17,600	0	8					May require 3-5 of these type offices and possibly some smaller type in development of this region.
Technical		"		18(5/2)	1,600	28,800	4	18					
Clerical		"		16(5/2)	900	14,400	12	16					

TABLE A-11 (continued)

Support Facilities and Employee Types	Per Rig Operation	Per Platform Operation	Per Unit of Production	Total Number of Employees	Avg. Wages $/Month	Total Wages $/Month	Employees Hired Locally	Employees Maintaining Local Residence	Area Requirements In Acres	Onshore Capital Investment 1974 - $	Character of Space	Special Factors	Comments
Gas Processing Plant			300,000 MCFD						75	24,000,000	Rural Area Desirable	Highway & Rail Access	Development of this region may require 3-6 of these plants.
Co. Employees			"										
Supervision			"	2(5/2)	1,650	3,300	0	2					
Technician			"	5(5/2)	1,200	6,000	2	5					
Operators			"	8(5/2)	1,200	9,600	5	8					
Maintenance Employees			"	5(5/2)	1,050	5,250	5	5					
Contract Employees			"										
Service			"	1(5/2)	600	600	1	1		$75,000,000			
			1,000,000 MCFD	34 Total									
Pipeline Shore Terminal			200,000 BOPD						40	2,400,000	Rural Area Desirable	Highway Access	This type installation would be constructed if production of oil is transported to refineries thru onshore pipelines.
Co. Employees			"										
Supervision			"	1(5/2)	1,800	1,800	0	1					
Gauger			"	4(7/7)	1,250	5,000	2	4					
Roustabout			"	6(7/7)	1,050	6,300	6	6					
Technician			"	2(7/7)	1,250	2,500	1	2					Development of this region may require 3-5 of these type terminals.
Dispatcher-Clerk			"	4(7/7)	1,150	4,600	4	4					
Pipeline Tanker and Barge Terminal			500,000 BOPD						60	9,800,000	Rural Area	Water-front, 35' Water	This type installation would only be necessary if the decision was made not to use pipelines for oil transportation to refineries.
Co. Employees			"										
Manager			"	1(5/2)	2,500	2,500	0	1			Stable Soil Founda-tion	Depth Req'd. 2 Berths	
Supervision			"	4(7/7)	1,800	7,200	0	4					
Gauger			"	8(7/7)	1,250	10,000	6	8					Development of this region should require only one such terminal if found necessary to build.
Roustabouts			"	6(7/7)	1,050	6,300	6	6					
Dispatcher-Clerk			"	4(7/7)	1,150	4,600	4	4					
Technician			"	2(7/7)	1,250	2,500	1	2					
Service Support	10-20 Rigs								4	900,000	Industrial Zoning	Inland Water Docksite with access to Atlantic	A minimum of 10 rigs will be necessary to justify establishing this type facility.
Mud Supplier	"												
Office Employees	"			7(5/2)	1,350	9,450	2	7					10-20 rigs will attract 2-3 suppliers. Full development may attract as many as 5.
Marine Employees	"			16(7/7)	1,250	20,000	8	16					
Wireline Company Base Employees	10-20 Rigs "			15(5/2)	1,100	16,500	7	15	6	1,200,000	Industrial Zoning	Highway access	Same as above.
Gas Lift Company Employees	10-20 Rigs "			5(5/2)	1,200	6,000	3	5	5	50,000	Industrial Zoning	Highway access	Same as above.
Logging and Perforating Co. Base Employees	10-20 Rigs "			10(5/2)	1,200	12,000	5	10	4	300,000	Industrial Zoning	Highway access	Same as above.
Welding Shop	10-20 Rigs								2	75,000	Industrial Zoning	Highway access	Development of this region may attract as many as 10 of these shops.
Welders & Helpers	"			20(5/2)	1,000	20,000	20	20					
Clerical	"			3(5/2)	600	1,800	3	3					
Rental Tool Co. Employees	10-20 Rigs "			10(5/2)	1,450	14,500	5	10	3.5	400,000	Industrial Zoning	Highway access	Same as above.
Fishing Tool Co. Employees	10-20 Rigs "			9(5/2)	1,400	12,600	4	9	1	200,000	Industrial Zoning	Highway access	Same as above.
Wellhead Equipment Co. Employees	10-20 Rigs "			12(5/2)	1,400	16,800	4	12	1.5	200,000	Industrial Zoning	Highway access	Development of this region may attract 3-5 companies.
Machine Shop Employees	10-20 Rigs "			9(5/2)	1,350	12,150	9	9	1	275,000	Industrial Zoning	Highway access	Development of this region may attract 5 of these shops and utilization of 5 existing shops.
Trucking Firm Employees	10-20 Rigs "			15(5/2)	900	13,500	15	15	5	255,000	Industrial Zoning	Highway access	It is estimated that 2 of these firms will be needed to supplement existing firms.
Cementing Co. Employees	10-20 Rigs "			12(5/2)	1,100	13,200	5	12	5	950,000	Industrial Zoning	Inland water dock-site with access to Atlantic. Highway & rail access.	Same as stated for Mud Suppliers.

TABLE A-11 (continued)

Support Facilities / Employee Types	Per Rig Operation	Per Platform Operation	Per Unit of Production	Total Number of Employees	Avg. Wages $/Month	Total Wages $/Month	Employees Hired Locally	Employees Maintaining Local Residence	Area Requirements In Acres	Onshore Capital Investment 1974 - $	Character of Space	Special Factors	Comments
Supply Store Employees	10-20 Rigs "			9(5/2)	1,000	9,000	5	9	2	110,000	Industrial zoning	Highway access	Same as stated for Mud Suppliers.
Downhole Equipment Co. Employees	10-20 Rigs "			11(5/2)	1,250	13,750	4	11	2	130,000	Industrial zoning	Highway access	Development of this region is expected to attract 6 of these companies.
Diving Service Employees	10-20 Rigs "			11(5/2)	1,900	20,900	9	11	.5	150,000	Industrial zoning	Highway access	Development of this region is not expected to attract more than one major company.

NOTE: All company types listed under Service Support require a minimum of 10 rigs operating in order to justify establishing the type of facility shown.

Source: Offshore Operators Committee, 1976

Table A-12. Industry Estimates of Onshore Facility Requirements for OCS Oil and Gas Operators

Stimulus	Number Possibly Required for Full Development of Region	Company Type
Minimum of 10-20 rigs working to establish facility 10-20 rigs could attract 2 to 3 facilities	5	Mud Suppliers Wireline Company Gas Line Company Logging and Perforation Company Cement Company Supply Store
Minimum of 10-20 rigs working to establish facility	Up to 10	Welding Shops Machine Shops Fishing Tool Company Rental Tool Company Wellhead Equipment Supplier
Minimum of 10-20 rigs working to establish facility	3-5	
Minimum of 10-20 rigs working to establish facility	5 in addition to existing facilities	Machine Shop
Minimum of 10-20 rigs working to establish facility	2 in addition to existing facilities	Trucking Firm
Minimum of 10-20 rigs working to establish facility	Not more than 1	Diving Service

Source: Offshore Operators Committee, 1976

The remainder of the onshore facilities which could result from the proposal, gas processing plants and terminal and storage facilities, are constructed to service production operations and are geared to peak levels.

Terminal facilities would be located near the landfall of pipelines, and the oil pipelines could then be built to refineries for processing of the crude oil. Because it is expected that the oil will be processed in existing refineries, tanker transport from onshore terminals to the refining center should be considered as well as pipeline transportation from the onshore pipeline terminal to an existing refinery, or to a refinery that may be built prior to the availability of crude oil from the proposed sale area.

The location of gas processing plants will also be influenced by marine pipeline routes. Therefore, gas processing plants could be located near oil pipeline terminals, if gas pipelines share corridors with oil pipelines. The shortest marine routes for all pipelines with the least environmental impacts would be sought. However, constraints such as bottom conditions (offshore) and appropriate landfalls must also be taken into consideration (offshore pipelaying is discussed in Section III.A., and pipeline approval procedures are discussed in Section IV.D.1.).

Other factors that may be expected to have some influence on the location of gas processing plants would be the identity of the purchaser of the gas, any existing facilities that could transport the gas, and the availability of suitable rights-of-way for pipelines between the gas processing plant and interstate pipeline facilities.

For the purpose of estimating the socio-economic impact that might result from this proposed sale, the location and capacity of two hypothetical gas processing plants were postulated. For some hypothetical cases, a processing plant employing 25 persons was assumed for Charleston County, S.C. In other hypothetical cases, an additional gas processing plant of larger capacity employing 30 persons was assumed to be built in Duval County, Fla., or Glynn County, Ga.

E. PLATFORM FABRICATION

Platforms must be constructed for the development and production phase. The U.S. now has platform fabricating yards in Louisiana, Texas and California. Platforms have been constructed in these yards and transported to many other offshore areas including the North Sea. Platforms for the U.S. South Atlantic could be constructed in these existing yards. If additional capacity is needed or other market conditions warrant it, existing yards could be expanded or new yards might be built nearer to production areas. Since traditional shipyards are usually not suitable for platform fabrication, a new site would probably be needed for construction in the frontier area.

The President of J. Ray McDermott and Co., a major fabricating company in Louisiana, presented testimony at the Council on Environmental Quality hearings concerning platform construction for the Atlantic OCS. He indicated that in the early stages of development, platforms would probably be supplied from fabricating yards in the Gulf of Mexico area.

However, Brown & Root, another major platform fabricator, has taken a different approach. It has already purchased a 2,000-acre site for a fabrication facility in Cape Charles, Va., which is on the Delmarva Peninsula and near the major shipbuilding area around Norfolk. Since the site is in a county with no industrial zoning, the construction of the facility is contingent upon a favorable zoning ruling. To date, no final decision has been reached. If the facility is constructed, platforms could be constructed for the Atlantic OCS as well as other offshore areas, depending on where platforms are needed when the company is ready to seek contracts. Since other items can be produced from such a facility including light metal tanks, metal storage bins, LNG tanks, and structual modules, its economic viability would not necessarily be dependent upon platform fabrication.

Chicago Bridge and Iron purchased a 635 acre waterfront tract on Port Royal Sound near Beaufort, South Carolina, approximately four years ago, and plans to construct a facility for the production of tanks for LNG ships and other marine related metal plate structures. Construction of this facility has not been undertaken pending the outcome of litigation on the permitting procedure.

The July, 1976, issue of Ocean Industry contained a summary of platforms under construction and the locations of the yards in which the construction was being carried out. Platforms for use in Trinidad were being constructed in Texas yards, and a platform for use in Nigeria was being constructed in a Louisiana yard in addition to platforms for use in the Gulf of Mexico.

f. POSSIBLE CONSTRAINING FACTORS

The investments and resulting facilities and employment anticipated to result from this proposed sale depend on availability of investment capital as well as labor and materials.

Funds for capital spending in the petroleum industry come largely from retained earnings, the remainder coming from borrowing and stock offerings. While declining profits and increased taxes caused predictions that exploration and drilling would be cut back in 1975, actual and planned cutbacks in these activities in 1975 were not as extensive as those in refining and marketing. The cutback in refining and marketing reflect regulations which lessen the profitability of these sectors, while strong demand and higher prices were among other factors attributed to the strong drilling and exploration in 1975. Capital can be allotted where the highest return is expected. Allocations can also be shifted between drilling and producing regions as well as between different sectors of the industry.

Recent supply difficulties in the oil industry stemming largely from steel shortages affected tubular goods used in the offshore industry. However, present indications are that this shortage has eased. While spot shortages may persist, they are not expected to pose a serious constraint for this proposed development.

With regard to drilling rigs, a surplus is developing according to an article in Business Week (9/1/75), which reports that there will be more rigs delivered this year than can be absorbed by industry. In two years, the 157 drilling rigs under construction will add to the existing fleet of 300. Lessening activity in the Gulf of Mexico and unfavorable results or conditions in foreign areas could also increase the availability of rigs for use in U.S. frontier areas. A drop in the operating cost of drilling rigs is accompanying the developing surplus.

Dixilyn International, Inc. indicates slightly different statistics (W. N. Plamondon, Jr., Written Testimony, DES for Proposed OCS Lease Sale No. 40, USDI-BLM, 1976). As of January 1, 1976, world-wide, there were 256 active competitive exploratory mobile rigs. Sixty-six of these units are working in the Gulf of Mexico and two are working offshore California.

Worldwide today there are at least 30 units "stacked" and not working. There are three units stacked in the Gulf of Mexico and at least three additional units which will be available in a short time.

In addition, there are 107 units currently under construction in the world. Sixty-eight of these units do not have contracts. Twenty-nine mobile units are under construction in U.S. shipyards and two units in Canada. A number of these units do not have contracts for employment.

There continues to be a shortage of petroleum engineers and highly skilled rig and platform workers. Petroleum engineers are being supplemented by other types of engineers who are provided training in the petroleum field. Likewise, skilled workers are being developed through on-the-job training. Many skills found in other industries are easily adaptable to the offshore petroleum industry; e.g., welders and mechanics. While skilled specialized labor could present a problem, the nature of the labor force in some portions of the coastal region, unemployment levels, and training programs should be able to alleviate the problem to the degree that it will not pose a major constraint to development in the region as a result of this proposed sale.

8. Cumulative Aspects of the Proposal

a. ADDITIONAL OCS OIL AND GAS LEASE SALES

The U.S. Geological Survey, in Open File Report 75-411, provided an estimate of the undiscovered resources of oil and gas that may be present beneath the Atlantic Outer Continental Shelf adjacent to the states of North and South Carolina, Georgia, and Florida. The report cautioned that "These undiscovered recoverable petroleum resources are those quantities of oil and gas that may be reasonably expected to exist in favorable settings, but which have not yet been identified by drilling. Such estimates therefore carry a high degree of uncertainty." (USGS, 1975).

The procedure employed by the Geological Survey in conducting their appraisal was also described in the report. The procedure consisted of a) carefully reviewing the available geological and geophysical data gathered by area specialists, b) individual and collective appraisals of the areas using volumetric-yield procedures, basin analysis, Hendricks potential area categories, and other published techniques, and c) computer fitting of the Resource Appraisal Group's subjectively assigned statistical probabilities for the high, low and modal resource values to a lognormal proba-

bility distribution curve for each geologic province.

To provide a range for potential development events, the report also provided estimates of the number of wells, platforms, miles of pipeline, and onshore terminals at two levels of undiscovered resources. These two levels were the statistical mean and the 5% probability values (the higher the resource estimate, the lower the probability of discovering that level).

The area of the Shelf is less than 200 m of water has been generally described as the Southeast Georgia Embayment. In this province the Geological Survey publication estimated that undiscovered recoverable petroleum resources at 5% probability level (1 in 20 chance) would amount to 1.5 billion barrels of oil and 2.8 trillion cubic feet of gas.

Under the higher of these resource volumes, estimates indicate that 20-25 platforms, 440 producing wells, 800 km of pipeline, and 4 onshore terminals may be needed for development and production. The time frames for production, using the highest estimates, were forecast to include 6-7 years after the sale before production commenced, 4-5 years following that to complete significant development, and 12-16 years after the sale until peak production was achieved.

In water depths between 200 m and 2500 m, in the area designated as the Blake Plateau Province, an additional 2.5 billion barrels of oil and 0.4 trillion cubic feet of gas resources (at the 5% probability level) could be present. A possible offering of leases in this area is presently scheduled for the year 1978.

At the present time, no oil or gas has been discovered in the Atlantic offshore areas adjacent to the Southeastern U.S., and, therefore an assumption that oil or gas exists in commercial quantities cannot be made with certainty. The Geological Survey estimated the probability of finding oil and/or gas in commercial quantities was approximately 40% for the South Atlantic and 30% for the Blake Plateau Provinces (corresponding to a 60% and 70% probability of finding no oil or gas in commercial quantities).

It is probable that more than one sale, or offering of acreage, on the OCS, will take place in the area adjacent to the southeastern U.S., and that any commercial discoveries of oil and/or gas on the acreage leased will lead to additional development activities related to drilling, platform and pipeline construction, and logistics support. Similarly, additional or expanded onshore facilities may result from activities undertaken in the course of the proposed and subsequent sales.

Since proposed Sale No. 43, covering leases in only a portion of the Southeast Georgia Embayment, is the first offering of acreage in this frontier area, the results of this proposed sale will undoubtedly have some influence on subsequent leasing, exploration and production activity on the OCS in this general area. The onshore socioeconomic effects of the exploration and production activity of multiple sales, could, of course, be of longer duration than the effects resulting from a single sale. In the event that the exploratory drilling resulting from proposed Sale No. 43 was successful, interest in the general area would be enhanced, and additional drilling would be expected to occur in areas leased subsequent to the leases awarded as a result of proposed Sale No. 43.

If the exploratory drilling resulting from proposed Sale No. 43 is unsuccessful, a lower level of leasing and exploration activity in the adjacent areas would be the most likely result, with the proviso that uniformly discouraging results from the exploratory activity resulting from the initial sale would not necessarily result in the discontinuance of exploratory activity on the entire U.S. South Atlantic Outer Continental Shelf.

The experience gained as a result of proposed Sale 43 would provide additional information which might permit more precise planning for future sales.

In this context, the effects of proposed Sale No. 43 may contain implications of cumulative impacts beyond those associated only with this proposed sale. Generally, discovery of oil and gas in a frontier area can be expected to lead to higher levels of exploratory activity, and if further success accompanies these incremental exploration activities, additional production and construction activities would probably ensue.

The impact of multiple sales could take several forms. One possibility would be the continuation of a given level of activity for a longer period of time, or, in the event that development activities related to more than one sale took place concurrently, the effect would be an impact greater than that due to a single sale. Probably, the results of multiple sales would be a combination of these effects.

In addition to possible lease sales subsequent to proposed Sale No. 43, offerings of OCS acreage are being considered for several adjacent areas. Additional lease offerings are proposed for the Mid-Atlantic (Sale No. 49), and for the North Atlantic (Sale No. 42), and subsequent sales have been included in the Proposed OCS Planning Schedule (USDI, 1976).

Incremental additions to transportation and processing facilities, as well as the relocation of firms supplying equipment required for OCS operations may result from the expansion of oil and gas development to the coastal areas of the Atlantic coastal states.

The estimates provided in Appendix B refer to estimates prepared by the Geological Survey specifically for this proposed sale, and therefore, the frame of reference and the analysis procedure for these estimates is different from the above province-wide estimates.

Determination of the cumulative impacts that might result from the initial offering of leases in the South Atlantic portion of the U.S. Outer Continental Shelf is difficult to visualize, due to the unknown physical location and quantities of oil and gas that might be discovered. Comparison with the marine areas of the Gulf of Mexico may provide some guide to a total development concept, if it is kept in mind that different development patterns may emerge as conditions between the two regions differ.

The following estimates of the ultimate recovery of oil and gas as of December 31, 1975 were obtained by adding estimated reserves to cumulative production.

The estimated ultimate recovery of natural gas in the Gulf of Mexico offshore amounted to 59.3 trillion cubic feet. The estimated ultimate recovery of oil was estimated to amount to 7.3 billion barrels. These estimates cover proven resources developed by drilling activity dating from 1954 in the case of both oil and gas.

The ultimate recovery from proposed Sale No. 43 may amount to as much as 1 billion barrels of oil and 6.8 trillion cubic feet of gas, based on the high estimates provided by the Geological Survey. These volumes amount to aproximately 14% of the oil and 11% of the gas volumes estimated to be recovered in the Gulf of Mexico OCS as a result of oil operations carried on during the period 1954 to 1975.

On the OCS portion of the Gulf of Mexico approximately 2,075 fixed platforms, including both single and multiwell structures, were in place at the end of April 1976. Approximately 7,295 miles of oil and gas pipelines, including 3,100 miles of common carrier pipelines, were in place. Approximately 6,100 wells, and approximately 5,500 dry holes had been completed by the end of 1975.

Offshore operations made use of eighteen ports in Louisiana, and 10 airports and heliports were used in part for the support of marine operations.

During the year 1972, approximately 5,100 persons were employed in offshore drilling in the West South Central census division; and approximately 3,300 additional persons were employed in providing exploration and other services. Comparable figures for the year 1967 were 4,400 persons in offshore drilling employment, and 2,500 additional persons in offshore exploration and other services.

The offshore production of crude petroleum and natural gas employed 4,300 persons in the West South Central division during 1972, compared to 2,300 persons during 1967.

To the extent that the experience in the Gulf of Mexico can be applied to other OCS areas, and this application should be done with full recognition that there is little or no reason to expect the historical events in the Gulf of Mexico region to be exactly duplicated in another area, some concept of the overall results of exploration and production activities in an area may be formed from the above relationships.

B. MID ATLANTIC OCS DEVELOPMENT

The cumulative impact of tentative OCS Lease sales in other regions has been addressed in the Final OCS Programmatic EIS, released by the Bureau of Land Management in July 1975. It is possible that, if the Secretary of the Interior decides to hold this proposed South Atlantic lease sale, cumulative impacts may result from the operations generated by that proposed sale and Sale No. 40 in the Mid-Atlantic.

The Mid-Atlantic Sale No. 40 resulted in the leasing on August 17, 1976, of 93 tracts (214,272 hectares or 529,566 acres) in waters 40 to 185 meters deep. The tracts are located offshore of New Jersey and Delaware with distance to shore ranging from 79 to 147 kilometers (49 to 91 miles). Estimated recoverable resources as a result of proposed Sale No. 40 are 0.4 to 1.4 billion barrels

of oil and 2.6 to 9.4 trillion cubic feet of gas. Table A-13 indicates estimated cumulative requirements and effects as a result of both sales.

It is possible that the combination of OCS-produced oil from both the South Atlantic and Mid-Atlantic could contribute to the expansion of existing refining capacity in the Mid-Atlantic. (A decision to expand existing refining capacity in the Mid-Atlantic areas would also be based, in part, on demand for refined products). Analysis indicates that a refinery expansion of 200,000 barrels/day could contribute an additional 3300 jobs to the Mid-Atlantic, as well as other incremental economic benefits (Section III.E.3.). Increases in economic activity in the Mid-Atlantic could probably be met with increased productivity and the fuller utilization of existing factors of production.

An increased refinery expansion to which the two sales may contribute could require new land dedicated to refineries. Approximately 400 hectares (1000 acres) are required for 200,000 barrels/day of capacity for a grassroots refinery. However, refinery expansion may also be accomplished on existing refinery sites. An expansion in the Mid-Atlantic of 200,000 barrels/day, about 15%, would add to the existing levels of sulfur oxides (22%), nitrogen oxides (7%), and hydrocarbons (30%), generated during periods of peak production. (SDI-BLM, 1976). These figures would also include the increased air pollution from the commercial and industrial changes that would result from the expansion. Increases of SO_x and NO_x would be serious enough to cause air pollution standards to be exceeded, since these areas often have difficulties meeting the standards at present.

Economic analyses indicate that neither Sale No. 40 or proposed Sale No. 43 would necessarily provide enough incentive to stimulate OCS-related activities which are not essential to a producing area, such as rig construction (support bases, transportation facilities, and in most cases, gas processing plants are facilities which are necessary in a producing area). Just as additional sales in any one region may serve to provide this impetus, so could sales in adjacent regions when proximity to one production area is not required. Platform fabrication is another example. While platform fabrication is related to overall demand at more than one location, a platform fabrication facility could be located in the Mid- or South Atlantic regions. This could occur should transportation costs outweigh the investment cost of a new facility when regional demand is taken into consideration. Other factors include an individual company's market position, and the possible competitive advantage of a Mid-Atlantic site (or a possible additional Mid-Atlantic site, should the 980 acre planned Brown and Root facility be built in Virginia). However, should concrete platforms be utilized for either the Mid-Atlantic or South Atlantic, it is probable that they would be located in the Mid-Atlantic region to provide platforms for both areas.

Areas situated shoreward between the two proposed sale areas could experience increased land use and socio-economic impacts as a result of both sales.

The COST well recently drilled in Georges Bank was serviced out of Davisville, Rhode Island. In addition, Davisville has been chosen as a site for Clean Atlantic Associates oil spill contaminated and cleanup cooperative operations, recently contracted to Haliburnton Services. At present, the site is to service Mid-Atlantic OCS operations. Presumably, a similar location in the South Atlantic area would be selected to service in the initial exploratory drilling resulting from proposed Sale 43.

Should facilities not required spacifically for either sale individually be developed as a consequence (or partial consequence) of both sales, land use dedicated to OCS-related facilities in one or both of the sale regions would increase substantially. The size of a platform fabrication yard, for construction of conventional steel platforms, would require a minimum of 40 to 120 hectares (100 to 300 acres) and could require as much as 400 hectares (1000 acres). A concrete platform construction facility would utilize up to 40 hectares (100 acres).

Facilities proposed to be located in southeastern New England, or elsewhere in the Mid-Atlantic, as a result of both Sale 40 and proposed Sale 43, whether directly required for servicing offshore operations, or stimulated (at least in part) by OCS activities, such as platform fabrication and refinery, will be subject to State and local land use and environmental controls. Land use analysis indicates that sufficient suitable land for industrial development exists in the South Atlantic.

TABLE A-13

Cumulative Effects

	Sale No. 40		Proposed Sale No. 43		Both Sales	
	Low	High	Low	High	Low	High
Recoverable Resources						
Oil (billions of barrels)	0.40	1.40	0.28	1.01	0.68	2.41
Gas (trillion cubic feet)	2.60	9.40	1.89	6.81	4.49	16.21
Wells						
Exploratory	60	240	95	220	155	460
Development	200	800	160	500	360	1300
Platforms	10	50	10	25	20	75
Pipelines						
Offshore kilometers (miles)	161 (100)	725 (450)	257 (160)	515 (320)	418 (260)	1240 (770)
Onshore kilometers (miles)	56 (35)	193 (120)			56 (35)	193 (120)
Pipeline Terminals and Storage Facilities	1	4	1	2	2	6
Onshore Operating Bases	1	4	1	3	2	7
Gas Processing Plants (300-500 mmcf/d capacity)	3	8	1	2	4	10
Land Use						
For pipeline terminals, operating bases, support companies, piepcoating and gas processing plants. In hectares (acres)	65 (160)	261 (645)	44 (109)	108 (267)	109 (269)	369 (912)
For pipelines. In hectares (acres)	170 (420)	583 (1440)	390 (964)	768 (1898)	560 (1384)	1351 (3338)
For possible platform fabrication (in addition to planned 980 acre facility in Cape Charles, Virginia) In hectares (acres)					440 (1100)	

Should any of these facilities be developed, additional environmental effects could be felt. Dredging might be required for platform fabrication facilities. Since all of the above facilities require large sites, construction associated impacts, surface runoff and possible habitat destruction would also result. The extent of these impacts would depend on the location, size and design of such facilities, and have not been quantified at the present time.

Civilian employment in the Mid-Atlantic region as a result of Sale No. 40 is expected to peak at 12,500 in the mid-1980's. Employment in the South Atlantic is estimated to be the greatest around 1988, with up to 7818 persons employed as a result of proposed Sale No. 43. The greatest aggregate employment for the Mid and South Atlantic regions is estimated at approximately 20,000. A noticeable impact anticipated from the two sales is intraregional movement of persons seeking employment.

It is anticipated that much of the onshore activity resulting from proposed Sale No. 43 will take place in the southeastern coastal states. OCS related development could employ some of the currently unemployed in that area. However, unemployment rates, on a county level, are not estimated to be reduced by more than one percent as a result of the proposed sale.

The above employment figures do not consider platform fabrication. Should such a facility locate in the Mid-Atlantic as a result of one or both of the sales (Sale No. 40 and proposed Sale No. 43), significant employment would result (in the order of 1000 primary jobs) and would impact the labor force substantially on a local basis.

Depending upon the size and skills of the existing labor force, and existing jobs, unemployment could be decreased much greater than one percent on a localized basis. It is also possible that persons could be drawn from other jobs.

The peak population increase estimated for the Mid-Atlantic as a result of Sale 40 is about 25,000 persons (previous to peak production). The peak population increase estimated for the South Atlantic as a result of proposed Sale No. 43 is also about 22,000 (occurring at peak production period). The combined effect of both sales is estimated to increase the peak population for the Atlantic coastal region (Mid and South) by about 47,000, occurring around 1988-1990. Should South Atlantic OCS-produced oil be shipped to the Mid-Atlantic, and stimulate refinery expansion it is estimated that a miximum population increase of 6,800 would result in the Mid-Atlantic region.

These population increases could be expected, in the Mid-Atlantic and South Atlantic, to concentrate in existing areas of industrial development and urbanization, where infrastructure such as road and sewer networks are well developed and the increased population would not add significantly to existing demand. An exception may be housing, as vacancy rates in these areas are generally low. In the South Atlantic, a majority of the population increase would be expected to be focused in the southeastern coastal states which have a wide variety of existing infrastructure systems. If development were to concentrate in localities which have experienced declining growth rates and whose road networks, sewer systems, schools, etc., are not currently strained, less impact would be expected than would be in undeveloped areas. Likewise, the metropolitan areas, due to their extensive infrastructure system, would probably not feel a significantly greater demand on services. However, especially if concentrated, this population increase could result in the need for increased governmental expenditures for a combination of physical investment in infrastructure (e.g., roads and sewers) and provision of services (e.g., police protection and increased governmental overhead).

Increases in air and water pollution as a result of population increases would not be expected to be great. However, increased demand for water, if occurring in northern New Jersey as a result of refinery expansion-induced population, would further extend the current shortage of water existing in that area. A population increase of 6800 would increase water demand by 6,800,000 gallons/day.

Whether or not refinery expansion occurs in the Mid-Atlantic, that area should not be subject to greatly increased petroleum-related shipping. (A) Should South Atlantic OCS-produced oil be tankered to existing refineries in the Delaware River Basin, this tankering, along with the chances of Baltimore Canyon platform and pipeline spills reaching the New Jersey coastline, would subject that coastline to increased chances of pollution. (B) Tanker movements from the Southeast Georgia Embayment, in combination with the small chances of Baltimore Canyon platform spills reaching Long Island, could subject Long Island

and the Raritan Bay area to increased chances of oil spills. However, over 150 million short tons (1973) of petroleum and petroleum products are currently entering New York harbor. (C) However, as tanker traffic resulting from proposed Sale No. 43 is not expected to exceed one tanker per day, the increases in vulnerability to oil spills as a result of the Southeast Georgia Embayment production should not be greater.

Impacts to biological communities resulting from oil spills, chronic low level oil pollution, and other substances introduced into the environment as a result of the two sales will, for the most part, be additive. Planktonic and benthic species, common to both areas, are probably individual members of different populations. Therefore, effects from oil spills and/or other activities resulting from the proposed Sale No. 43 and Sale No. 40, including mortality, would be localized within the region of the breeding populations.

The impacts to fish populations posed by offshore spills would not be greatly magnified by sales occurring in the two areas. Spills occurring simultaneously in the two areas would not be expected to act in concert, since offshore oil spills are localized events and the probability of exposing the same population to oil spills located over 160 kilometers (100 miles) or more apart, in successive fashion, would be remote.

Cetacean species migrate through both the Mid- and South Atlantic areas. To the extent that they would be subjected to possible effects of oil and other pollution as a result of both sales, greater impacts to marine mammals could result than would occur should only one of the sales be held. However, as knowledge of marine mammal populations is incomplete, it is difficult to predict any population impacts.

Impacts to wildlife resources, such as individual mortalities and habitat destruction, as a result of the proposed South Atlantic Sale and Sale No. 40 in the Mid-Atlantic could be additive in nature, for instance, waterfowl habitat. It is possible that the habitat utilized by the same populations of migrating waterfowl could be affected by spills in both regions. As all wetland habitat on the Atlantic is of importance for migrating waterfowl, oil spills or other impacts to wetlands could affect water, adding more stress to populations.

For example, in the South Atlantic region, the probability of an oil spill contacting a wildlife refuge ranges from 1 to 5%, of contacting marsh and wetlands from 3 to 8%, and of contacting a migration route along the coastline from 57 to 88%. A large oil spill may contact 5% of the beach area in the South Atlantic coastal areas.

An impact on migrating waterfowl could effect this population in both the South, and Mid-Atlantic areas.

While for the most, impacts to biological organisms discussed above would be additive in nature, impacts to those resources along the New Jersey coastline, and Delaware Bay and the southeastern coastal region could be subjected to oil spill related impacts to a greater degree as a result of the two sales. However, tanker traffic resulting from proposed Sale No. 43 (and probably going to the Mid-Atlantic or Gulf of Mexico) is not expected to exceed one vessel per day. This compares, for example, with approximately 12,500 inbound petroleum movements (vessel and barge trips) into New Jersey and New York in 1972. (TRIGOM, 1975.) Effects of oil spills on these resources are also discussed in the Final Environmental Statement for the Proposed OCS Lease Sale No. 40.

c. Dredging and Ocean Dumping

(*1*) *Dredging*

If onshore facilities requiring coastal locations and access to vessels were to be located in areas which cannot presently accommodate required drafts (15 feet), channel dredging would be required. Resuspension of bottom sediments, turbidity and destruction of habitat of marine organisms would occur. Dredging would require a permit from the U.S. Army Corps of Engineers and State authorities. The sites that would most likely be used for servicing the South Atlantic, Charleston, S.C., Savannah, Ga., and Jacksonville, Fla. can already accommodate vessels of the required size, and therefore, no cumulative impacts are expected.

If oil or gas pipelines are required for a South Atlantic find, some dredging would be required in the nearshore areas at which the pipelines come ashore. This would result in disturbance and/or mortalities to the local organisms.

(*2*) *Ocean dumping*

The ocean dumping sites that are designated along the South Atlantic coast as mostly used by hopper dredges and for munitions dumping. The materials that are dumped in these areas are sand, shells, and mud. These areas that have been designated by EPA all are close to shore and none

are in the immediate vicinity of the proposed lease sale. Since these areas are removed from the proposed action there will not be any cumulative impact.

Drilling mud and drill cuttings will be dumped during the exploration and production of the wells. During approximately 20 days of drilling to 10,000 feet approximately 2,000 barrels of bentonite clay and lignosulfonate treated mud would be discharged overboard. During the additional 70 days operations while drilling from 10,000 to 18,000 feet, the discharge rate will not exceed 50 barrels a day, approximately 4,000 barrels of lignosulfonate. When the well is completed, the mud remaining in the surface system is discharged overboard; and this can amount to as much as 800 barrels. The environmental effects of accumulations of drilling muds is not known, toxicity tests are known being performed on various types of drilling muds.

D. DEEPWATER PORTS

Deepwater ports proposals have been put forth for the offshore area of North Carolina, South Carolina and Georgia in "The Coastal Plains Deepwater Terminal Study" (R. R. Nathan Assoc., 1975) however, the Department of Transportation, the responsible Federal agency, has not received any permit applications for Atlantic Coast deepwater terminals to date.

The extent to which effects of a deepwater port operating concurrently with OCS oil and gas leasing activities in the U.S. South Atlantic region would be cumulative in nature would depend in part on whether such a port is built to accommodate existing crude imports or increased refinery capacity. (To a large extent, the provision of expanded refining capacity and associated deepwater ports will be a function of demand, market location and transportation economics). If deepwater ports on the Atlantic Coast result in a higher volume of crude transported and a higher volume of associated spills, then cumulative oil-related impacts to marine and coastal organisms could be expected. If deepwater ports are associated with new refinery capacity, cumulative economic and socio-economic impacts could accrue to the southeastern U.S. region. The extent and nature of these impacts would depend on the location of the port(s), and new refineries and OCS related facilities.

More information regarding the impacts of deepwater ports may be found in the Department of the Interior's Environmental Impact Statement on Deepwater Ports issued June 1973. Recent analyses of the impacts of deepwater ports are contained in the Coast Guard final EIS on the LOOP and SEADOCK projects. These documents, which also include the status of other deepwater port proposals, were filed with CEQ on December 17, 1976.

B. Offshore Impacts of Oil and Gas Operations on the Natural Environment

1. Impact on Phytoplankton

Species composition and a description of the habitat are discussed in Section II.E.1.a. Essentially, all the tracts of this proposed lease lie between the 20 m and the 200 m isobaths, and west of the Gulf Stream. Because of currents, winds, and other local influences, including Gulf Stream eddies, which are poorly understood, the distribution of individual species of phytoplankters is patchy and highly variable, and continually changing. As indicated in Section II.E.1.a. above, certain generalizations with regard to seasonality and distance from near shore to off shore; productivity is a maximum in the summer and a minimum in winter; no differences in north-south distribution can be detected; and all of the species may be found throughout the lease area at various times, but with no discernable distributional pattern. Because of the great local variability in distribution, the following discussion of impact on the phytoplankton must be in very general terms.

Exploratory drilling will create turbidity plumes during the disposal of drill muds associated with the cuttings. If we assume that these operations create a plume 20 m wide and 800 m long (plumes of this approximate maximum size have been observed in the Gulf of Mexico) then the euphotic zone will be reduced under a maximum of 16 ha of sea surface for the duration of drilling (approximately 15 days); the disposal of muds is not continuous, and the plume mentioned above is the maximum expected. The residence time for any single phytoplankter within this reduced euphotic zone would depend on the vertical and horizontal transport to which it is subjected. The field development phase will have similar impacts, but with longer duration. Assuming that a maximum of 20 wells will be drilled from each platform approximately 400 drilling days would be necessary and the turbidity plume would be present this period. This would result in a cumulative duration of 10,000 days for 25 platforms throughout the proposed sale area. This turbidity will reduce the photosynthetic assimilation of the total marine system in the proposed sale area by an amount that is dependent on the season, the distance from shore, and the particular organisms present at the drilling site at that particular time. Because the area affected at any one time will be quite small in comparison to the entire South Atlantic OCS, it is estimated that photosynthetic activity due to this turbidity will be reduced by only some small fraction of 1%.

The production phase can impact phytoplankton species through the disposal of formation waters (relict sea water) which contain the soluble fractions of crude oil at an average concentration of 30 mg/l and trace amounts of certain heavy metals such as iron, calcium, magnesium, and sodium (see Table A-3, Section III.2.A). As mentioned above the resultant receiving water concentration of petroleum hydrocarbons is difficult to assess, but if we assume instantaneous mixing into one cubic meter of sea water, the concentration would be approximately 30 mg/l. If excessive concentrations (greater than 30 mg/l) are discharged, a local inhibitory effect can be expected (Mironov, 1970), but these anomalous iron ratios present in formation water should cause minimal disturbance to the phytoplankton due to dilution. In any event, disposal of formation water at concentrations higher than mentioned above is considered very unlikely.

The Gulf Universities Research Consortium (GURC) study (1974) reported on the ecological impact of oil drilling and production on phytoplankton standing crop, primary productivity, nutrients, etc., in the Gulf of Mexico; the same general conclusions can probably be made about these impacts on the proposed lease areas in the South Atlantic:

> Chlorophyll *a* values were consistently higher at all depths sampled (except at the surface) at the Production Platform as compared to the Control Site. At both sampling sites, a marked increase in chlorophyll *a* in the samples collected near the bottom was noted and was indicative of large cell populations of the water column.

Primary Productivity

> Primary Productivity data at both the Platform and Control Sites showed remarkably similar results. Average daily primary production at the Platform is 1.06 g C/M^2 compared to 1.03 g C/M^2 at the Control Site.

Phaeo-Pigments (degradation production of chlorophyll a)

The distribution of the phaeo-pigments in the OEI (Offshore Ecology Investigations) area

showed a trend similar to that of chlorophyll *a*. Very high values of phaeo-pigment were found at the bottom of the Control Site indicating large cell populations at some prior time.

Photosynthetic Index (P.I.)

The photosynthetic index (or assimilation number) is usually considered as a "measure of the vitality of the phytoplankton organisms". During this study, the P.I. at the Control Site was found to be higher than at the Platform (38.95 and 28.57 mg C/mg Chl*a*, respectively). The values of the P.I. at both sampling sites reflected healthy growth of phytoplankton.

Cell Counts

The total cell counts/liter were found to be much higher at the Platform than at the Control Site.

Number of Species of Phytoplankton

The number of species of diatoms and dinoflagellates were found not to vary appreciably between the Platform and Control Sites.

Seasonal Variations

Seasonal variations in primary production, standing crop of phytoplankton, nutrient salts concentrations, cell counts, and number of species of diatoms and dinoflagellates were observed at both the Platform and the Control Site. As expected from seasonal impact, biological productivity is at its lowest ebb during the November-January period. Maximum phytoplankton density (climaxing in a bloom state) was reached during April, 1973 (flood stage).

Comparison of the Offshore Ecology Investigations (OEI) Data With That of the Overall Gulf of Mexico

When we compare the primary productivity, standing crop and nutrient data collected in the OEI region, with data collected in the Gulf of Mexico during the past nine years, we found that OEI data to be much higher than those collected from both the open Gulf of Mexico and on the continental shelf off Panama City, Florida.

Thus, the production phase is expected to have no significant adverse impact on offshore phytoplankton.

The transportation phase will affect the phytoplankton due to the pulse of turbid euphotic water created by the jetting of pipelines. This pulse will temporarily stress phytoplankton in the immediate vicinity of the operations. If bottom areas high in heavy metals, pesticides, or other pollutants are traversed, the effects will be more severe and possibly of longer duration. In any event, phytoplankton primary productivity will be temporarily altered in a zone of impact probably not exceeding 50 meters wide throughout the length of the pipeline route given water depths which allow the disturbance to reach the euphotic zone.

An oil spill will probably have a severe effect on the phytoplankton floating in the oil or at the oil-water interface. This effect will be relatively short-lived as the oil passes through any given area, and even if only a few cells survive the area will rapidly become repopulated—once the oil passes. The impact from such a spill will be greater in the summer than in the winter, and also greater in near shore areas than in offshore areas. Since there is apparently no north-south differences in distribution and since the oil spill risk analysis of Section III.A.5.b. indicates that most of the oil from a spill within the proposed lease areas will be transported north and south, the impact will be to all species rather than to any one phytoplankter.

In summary, it is believed that the offshore oil and gas operations envisioned by the proposed action will not significantly affect phytoplankton populations, and any reduction that does occur will be over a short time frame and will be temporary. This insignificant impact will be true even over the 20 to 25 year life of any production wells that may result from this proposed sale. For a more specific discussion of the impact of oil spills on littoral systems, see Section III.F.

2. Impact on Zooplankton

Species composition and a description of the habitat are discussed in Section II.E.1.b. As discussed in that section, zooplankton, like the phytoplankton, show no north-south trends with regard to distribution and show greater numbers in the summer and greater numbers near shore. Local distributions are quite variable and patchy. Thus the following impact on zooplankton must be discussed in general terms.

The turbidity generated during the exploratory and field development phases of OCS oil and gas operations may have an adverse effect on individual zooplankton in the immediate vicinity of the drilling rig. Zingula (1975) has shown that suspended solids concentrations in surface water near drilling discharges are of the order of 300 mg/l and are rapidly diluted to approximately 6 mg/l within 201 m (660 ft) of the discharge. An additional impact may be the temporary resuspension of bottom sediments during platform placement. (Hollister, 1973). Given the minimal relative volume of water affected and the duration of the discharge, these potential discharges should not adversely affect the zooplankton component of the marine ecosystem.

The dissolved components of crude oil present in production phase discharges may have an adverse effect on zooplankton in the immediate vicinity of the production platform. If we assume a local concentration of 30 parts per billion (Section III.A.2.), direct lethality should not be a problem. However, Lee (1975) has shown that various zooplankton of the Pacific and the Arctic Oceans can assimilate hydrocarbons from a seawater solution at low concentrations forming the necessary first step in food web concentration. This phenomena is discussed in general in Appendix I. Furthermore, reduction of phytoplankton due to the spill may cause zooplankton mortality due to lack of food. Another potential adverse effect involves the interference by petroleum hydrocarbons with chemically controlled behavior in zooplankton. The magnitude and importance of this potential impact is at present insufficiently known to allow prediction, but experience in the heavily developed area of the Gulf of Mexico indicates no cause for concern (GURC, 1974). The oil spill analysis of Section III.A.5.b. indicates that most of the oil from a spill will be transported north and south; since there is no significant difference in zooplankton distribution from north to south, about all than can be said is that in general, like the phytoplankton, the impact from a spill will be greater in the summer and greater in nearshore areas. All the species found in the area will be affected, except for local, short term aggregations of a species that may sometimes occur.

The possible transportation phase of OCS development in the Southeast Georgia Embayment whether by pipeline or tanker should be little effect on the zooplankton component. Pipelaying will result in the temporary resuspension of bottom sediments and the resultant turbidity will have a local short term effect on the zooplankton. In nearshore areas, the possibility of the liberation of absorbed toxicants should be taken into consideration in pipeline routing since sufficient concentrations of heavy metals or chlorinated hydrocarbons to stress zooplankton may be present. No such areas have been documented, but it is suspected that OCS areas under the influence of major industrialized rivers, such as the Savannah River, would have relatively high concentrations of such toxicants.

As is the case with phytoplankton, oil and gas operations may have a severe, but local and short-term effect on zooplankton populations, even over the life of any production that may result from this proposed sale. A major oil spill will cause the greatest damage, the extent of which will depend upon the season and the location of the spill, coastal waters having a greater sanding crop but shelf waters having a greater diversity of species. For a more detailed discussion of the impact of oil spills on littoral systems, see Section III.F.

3. Impact on Benthos

Species composition and a description of the habitat are discussed in Section II.E.1.c. All the proposed lease areas are located in water depths between 20 m and 200 m and thus the benthic assemblages impacted would be those of the outer continental shelf zone and the upper continental slope zone as described by Day et al. (1971). Also within the proposed lease area are a number of live (hard) bank areas, which are discussed in some detail in Section III.B.7. Unfortunately, little is known about specific locations of any given assemblage; baseline biological studies to determine benthic distributions will be made under contract to BLM before any drilling activity takes place, and it is expected that a detailed bathymetric study of each lease block will be made by the lessee prior to any drilling activity in order to determine the possibility of any biologically sensitive areas so that proper protective measures, such as shunting of the drill muds and cuttings, may be taken. The discussion which follows, then, is by necessity general in nature.

The exploratory phase effluents that may be expected to have an effect upon benthic organisms

include drill cuttings and drill muds. The sessile benthic organisms upon which the cuttings pile will accummulate will be buried by approximately 2,294 m^3 of cuttings generated by an exploratory well (Section III.A.1.b.). These cuttings usually form a low mound which is later worked into the surrounding sediments. The effect on benthic organisms is dependent upon the nature of the cuttings, nature of the local sediments, depth of disposal, benthic fauna capable of bioturbation and/or encrustation, and the physical factors (such as current) acting upon the cuttings pile. While the immediate effect of such burying is to eliminate those organisms which cannot get out of the way or cannot work their way to the surface of the pile, experience in the Gulf of Mexico has shown that the effects are temporary and that the pile is quickly recolonized.

The drilling fluids (muds), which are associated with the cuttings when they are disposed of overboard, are washed from the cuttings and eventually settle to the bottom after generally a wide dispersal through the water column. Jones and Williams (1973) found sediment barium concentrations to be above normal in areas of the Gulf of Mexico where intensive drilling has taken place. Barium sulfate is the major constituent of drilling fluids and the distribution of barium in the sediments suggest that the above-normal concentrations are due to the disposal of these fluids. Barium sulfate is a highly insoluble, nontoxic salt which is present in seawater at a concentration of approximately 0.05 mg/l and in certain localities concretions and nodules of barium sulphate are found in bottom deposits (Horne, 1969). However, certain chemicals, including bacteriocides, are added to the fluids under specific circumstances (see the Sheen Report, 1976, for a good discussion of the use of fluids and their effects); while it cannot be conclusively stated that these chemicals have no effect on the benthos, observations in the Gulf of Mexico during more than 20 years of operations indicate that such effects, if present at all, are minimal. Research is continuing in this area.

The field development phase will require the placement of platforms and the drilling of up to 20 wells from each of a maximum of 25 platforms. The initial platform placement and anchoring may temporarily disturb the benthic biota in the immediate vicinity. Longer term effects may include a change in the benthic community to reflect the presence of an artificial reef.

The production phase will result in the introduction of the soluble components of crude oil at an average concentration of 30 mg/l. These components may eventually be incorporated into the benthic food web. This will cause a shift in the sediment microflora to a community capable of utilizing petroleum hydrocarbons as an energy source. Those compounds, such as the heavier hydrocarbon fractions, which are not degraded may accumulate in the deeper sediment layers. No investigation that would determine if this is the case has been conducted in areas of offshore petroleum development.

The transportation phase may require the installation of pipelines. If so, certain impacts to the marine benthos will occur: In water depths of less than 61 m, new common carrier pipelines are entrenched by jetting away the sediment beneath the pipe and allowing the pipe to settle into the underlying trench at least 0.9 m (3 ft). Partial burial takes place quite rapidly as the disturbed sediments slide and settle back into the trench. It is recognized that in some areas there is insufficient sediment to permit pipeline burying. This is considered a moot point, however, since, the need for and location of pipelines utilized for production in the area cannot be foreseen at this time.

The jetting process physically disrupts the sediments in its path, and causes resuspension of large quantities of sediment. This process would have the effect of displacing benthic organisms and would result in direct mortality to others through increased vulnerability to predators. Although recolonization would begin immediately, the native fauna could not be fully restored until seasonal reproduction cycles have been completed by representative species from adjacent areas; these would provide a supply of larvae to settle and enter the reworked substrate.

Turbidity resulting from resuspended sediment is capable of producing an adverse impact on filter-feeding molluscan (i.e., clams and oysters) and other benthos populations by clogging the filter-feeding apparatus or blocking respiratory surfaces. This impact is temporary, occurring during burial operations, lasting from several hours to a few days, and would effect those populations adjacent to the pipeline. Currents carry the sediment and redeposit it at a distance depending upon the particle size of the sediment, the strength of the current, and the length of time of the burial operation.

As previously mentioned (Sec. II.A.1.), 257 to 515 km (160 to 320 miles) of pipeline may result from this proposed sale. Locations of these pipelines are unknown. It is expected that the area affected would be localized laterally to within 15 m (50 ft) of the particular operation throughout the water column. However, this distance may be decreased or increased depending upon the following variables: water currents, sea conditions, water depths, natural bottom sediment, and dispersion rate of bottom sediments from jetting operation.

Recovery rates would be dependent upon seasonal reproduction cycles and recolonization by indigenous and other species. Estimates for recolonization range from months (polychaetes) to several years (molluscs, echinoderms).

In order to assess the cumulative consequences of extended OCS development on the benthos a Cumulative Consequences Index (CCI) was constructed.

The purpose of this CCI is to analyze the combined impacts from large spills, plus small spills and chronic discharges, plus construction turbulence, plus drilling fluids on the biota, through time. The aforementioned stresses can have two major types of origin, pipelines and platforms.

For the purposes of worst case analyses, the pipelines can be considered to be inshore sources of stress and the platforms offshore sources of stress. The benthos can be separated into offshore and inshore communities, with each category possessing both resident and transients components. In many cases the transients are members of both the offshore and inshore communities, usually at various stages in their lifecycles. The young of many species are more vulnerable to the effects of these stresses than the adults. The effects of a particular stress can be expected to be increased in the inshore estuarine areas more so than in offshore oceanic waters. This can be expected because the estuarine areas are enclosed bodies of water and the pollutants would not be as widely dispersed and diluted as in the oceanic waters. Synergistic effects between the various stresses were not considered as we have no information on this.

All resident benthos would be available to these stresses at any time of the year, whereas the transient benthos would be available in certain localities seasonally. Oysters are an example of inshore resident benthos, quahogs are offshore resident benthos, and shrimp are transients benthos both inshore and offshore. Calico scallops are transients in the offshore areas.

The cumulative effects of oil spills, chronic discharges, construction turbulence, and drilling fluid discharges would probably have the most drastic negative impacts on resident benthos, like quahogs and oysters. The effect would probably be greatest on the offshore resident benthos as they are available to all the stresses from pipelines and platforms whereas the inshore resident benthos would primarily be affected by stresses associated with the pipelines. The stresses from platforms would be diminished or eliminated by the time it reached shore. Stresses such as construction turbulence, chronic oil spills, and drilling fluids would probably never reach the inshore areas at all. The oil from large spills occurring offshore would be weathered and its toxic effects greatly diminished if and when it reached shore.

Therefore, in the worst case analysis, the offshore resident benthos populations would be expected to suffer, relatively, the most serious population declines of the benthos as a cumulative result of extended OCS development.

In summary, structures, drilling, and the disposal of muds and cuttings will have a severe effect on the benthic organisms at the immediate site of these structures, wells, and disposals, but this effect is considered to be minimal, short term, and of no significance to any species or populations. Unique benthic areas, "live-bottoms" will be adversely affected by muds and cuttings disposal from drilling rigs operating on the feature or in the near proximity. The benthic organisms comprising these unique areas can have massive mortalities caused by smothering or toxicities of the drilling fluids.

Oil spills will have a deleterious effect on benthic areas where the water depth is shallow enough to permit mixing of the oil to the bottom. For a discussion of the impact of spills on hard (live) bottom and other benthic systems, see Section III.F.

Oil spills might have severe effects on benthic organisms in enclosed areas with poor flushing. Areas with the highest risk of spills coming ashore are the northeast Florida coast and the Cape Fear area of North Carolina. From the oil spill risk analysis data (Appendix M) the minimum time for the oil spill to reach the Florida coast

would be 12 days and the maximum would be 39 days. The minimum and maximum days required for an oil spill to reach shore in North Carolina are reported as 20 and 90 days respectively. Weathering will have had substantial effects on the oil by the time it reaches these shores even in the minimal time.

Therefore, we can forecast that there should be no catastrophic mortalities inflicted on the benthos.

The cumulative impact of this potential sale, plus any future sales that might occur in this same area, combined within the Mid-Atlantic areas to the north, could be partially additive in impacts. Until more information becomes available, an assessment of these impacts would be speculation at this time, and have little meaning.

4. Impact on nekton

Species composition and a discussion of the habitat are discussed in Section II.E.1.d. The nekton consist of free swimming animals such as fish, marine mammals, and certain crustaceans and molluscs. Thus, unlike benthic and planktonic organisms they are able to avoid structures such as rigs and debris and they can avoid oil resulting from a spill. However, there is no question that animals which might swim in oil contaminated waters, and which feed on phytoplankton or zooplankton that are contaminated, will themselves suffer an adverse impact. Depending on the concentration of the oil in the water, this impact will range from death to reduced health to tainting of the flesh of commercial species. While this impact might be severe in local areas, no species or populations as a whole will suffer any long-term impact. The impact on the commercial fisheries component of the nekton is discussed in more detail in Section III.C.6. (see also Section III.F.). A very minor impact on the nekton will be the exclusion of some portion of the water column to their use. As is pointed out below, however, structures may actually "improve" the habitat with regard to fish.

With the present day use of non-explosive energy sources for seismic survey work the pre-exploratory phase of development should have minimal adverse impact on the marine nekton. Falk and Lawrence (1973) report that while explosive sources killed fish over an area of hundreds of square meters, the non-explosive source tested caused no direct mortality. Weaver and Weinhold (1972) reported no harmful effects from non-explosive sources fired at various depths.

The exploratory phase will have a localized temporary effect on the nekton due to the physical presence of the rig and the disposal of drill cuttings and associated muds during the drilling of exploratory wells. The attraction of nektonic organisms, especially fish, to submerged structures is a widely recognized phenomenon and since drilling rigs are well lighted, this attraction may be enhanced at night. Observations in the Gulf of Mexico indicate that fish are also attracted to the drill cuttings as they cascade down through the water column where they may be sampled as food items and rejected. No definitive bioassays have been conducted with drill muds and species found in the planning area; however, Falk and Lawrence (1973) have found a wide range of lethal concentrations (from less than 1% to 12%) working with fresh water fish. Experience in the heavily developed areas of the Gulf of Mexico indicates that no severe adverse effects upon nektonic populations will result from exploratory drilling.

The field development phase will entail the installation of permanent (20 years average functional design life) platforms from which development wells will be drilled. The cuttings will be disposed of overboard where they will form low mounds on the bottom and subsequently be mixed with the underlying sediment or colonized by benthic organisms (Zingula, 1975). The platforms, like the drilling rigs, will attract the larger organisms immediately; but, due to their permanent nature, they also act as true artificial reefs with the establishment of a community of great diversity.

The production phase of offshore operations can impact the nekton through the disposal of formation waters which contain the soluble components of crude oil (30 mg/l) and trace amounts of certain heavy metals (see Table A-3, Section III.A.). The effects of these low-level chronic discharges are not quantifiable at present (Appendix I). However, due to the magnitude of dilution and the process of microbial degradation, no adverse effects upon nektonic populations have been noted in areas of intense oil and gas development.

The transportation phase, if by pipeline, will result in temporary, localized increases in suspended sediment which can be easily avoided by the actively swimming nekton. If transportation is by tanker, low-level operational discharges

of crude oil will occur. These should have little effect upon the nektonic component of the marine ecosystems in the area of this proposed action.

To assess the cumulative impacts from large spills, plus small spills and chronic discharges, plus construction turbulence, plus drilling fluids on the biota, through time; the major origins should be considered: pipelines and platforms.

For the purpose of worst case analyses, the pipelines can be considered to be inshore sources of stress and the platforms offshore sources of stress. The nekton can be separated into offshore and inshore communities with each category possessing both resident and transients components. In many cases the transients are members of both the offshore and inshore communities, usually at various stages in their lifecycles. The young of many species are more vulnerable to the effects of these stresses than the adults. The effects of a particular stress can be expected to be increased in the inshore estuarine areas more so that in offshore oceanic waters. This can be expected because the estuarine areas are enclosed bodies of water and the pollutants would not be as widely dispersed and diluted as in the oceanic waters. Synergistic effects between the various stresses were not considered as we have no information on this.

All resident nekton would be available to these stresses at any time of the year, whereas the transient nekton, would be available in certain localities seasonally. Seatrouts are an example of inshore resident nekton, snappers and groundfish are offshore resident nekton, and menhaden are transient nekton both inshore and offshore. King mackerel are transients in the offshore areas.

The cumulative effects of oil spills, chronic discharges, construction turbulence, and drilling fluids discharges would probably have the most drastic negative impacts on resident nekton, like snappers and seatrouts. The effect would probably be greatest on the offshore resident nekton as they are available to all the stresses from both pipelines and platforms whereas the inshore resident nekton would primarily be affected by stresses associated with the pipelines.

The stresses from platforms would be diminished or eliminated by the time it reached shore. Stresses such as construction turbulence, chronic oil spills, and drilling fluids would probably never reach the inshore areas at all. The oil from large spills occurring offshore would be weathered and its toxic effects greatly diminished if and when it reached shore.

Therefore, in the worst cases analysis, the offshore resident nekton populations would be expected to suffer relatively, the most serious population declines of the benthos as a cumulative result of extended OCS development.

In the nearly thirty years of extensive oil and gas activities offshore Louisiana, no decline in groundfish has been reported.

Right whales with very young calves have been sighted close to shore along the east coast of Florida (personal communication, R. R. Reeves, Smithsonian Institution). OCS oil and gas operations in this area could affect the productivity of this species.

In summary, routine operations resulting from this proposed sale have little adverse impact on the nekton. Oil spills will severely impact a relatively few individuals for a short period of time, but will have few serious or long-term effects. The most serious impact will most likely be to the commercial fisheries segment of the nekton (discussed in detail in Section III.C.6.), but even than should not be very widespread nor long lasting.

5. Impact on marine mammals

Oil and gas development on the South Atlantic OCS as a result of this proposal may impact marine mammals through potential oil spills. The direct effects of oiling on marine mammals could include the matting of pelage, irritation of skin and eyes, ingestion causing internal disorders, and possible clogging or inflammation of respiratory passages. Oil can also foul baleen plates, thus impairing the feeding efficiency of baleen whales. Secondary impacts may include decrease in or redistribution of food supplies.

Cetaceans (Whales, dolphins and porpoises)

There are approximately 24 species of cetaceans, including 5 endangered species (right, fin and humpback, Sperm and Sei whales) have been sighted off the South Atlantic states. There is, however, little information on the life histories of the cetaceans in the area. Lack of frequent sightings may be attributable to the absence of observers. Some species of marine mammals travel in herds and have a herd leader such as pilot whales. It is possible that if the herd leader were killed or disoriented the herd could become disoriented. The effects of an oil spill to these

groups would be determined by the effect of the oil spill on the herd leader. The effects of an oil spill on species which do not travel in herds would result in impacting only the individual animal.

No record is reported of cetacean deaths due to the direct effects of oil pollution. Numerous dead animals were found after the Santa Barbara spill, including grey, sperm, and pilot whales, dolphins and elephant seal pups. These marine mammals were examined histologically and chemically for the presence of oil or pathological effects related to oil and it was determined that mortality was not directly attributed to the oil spill. Attempts to reroute grey whales which were migrating through the vicinity of the Santa Barbara spill were unsuccessful.

A potential danger to cetaceans is absorption through the mucous membrane lining the blow hole distal to the nasal plug. This area remains open near the water surface and may become oiled. The ultimate outcome of oil exposure could be a thin oil film covering of the lungs and respiratory passages which has the same effect as pneumonia including death.

As cetaceans forage for such organisms as copepods, euphausids, and fish, localized decreases or redistributions of these organisms as a result of OCS activities could limit food availability for cetaceans. Ingestion of contaminated organisms as a result of an oil spill incident could occur. While young cetaceans might also ingest oil during their period of nursing, other effects of hydrocarbons upon mating, implantation, pregnancy, placentation and parturition are unknown for cetaceans. Chronic contributions of low levels of hydrocarbons and heavy metals as a result of OCS development is expected to be localized and not significantly alter concentrations of these substances in the South Atlantic (Sections III.A. and III.B.1.) in general. Therefore, uptake by cetaceans of substances generated by routine operations would be expected on only a limited basis because of their large forage area. (Appendix I discusses the fate of hydrocarbons and heavy metals in the marine food web in more detail).

Because of the endangered species status of some cetaceans, and their apparent limited distribution or occurrence in the South Atlantic region, any impact to individual cetaceans could have consequences on species populations or distribution. The Sei Whale (*Balaeoptera borealis*) is on the endangered species list and is present on the decline off the Southeast Atlantic States. Any further interference with the life cycle or habitat of this species could result in a further depletion. Other species such as the Humpback Whale (*Megaptera novaeangliae*), Black Right Whale (*Balaena gacialis*), Fin Whale (*Balaenoptera physalus*) and the Sperm Whale (*Physeter catodon*) are listed as endangered species.

Other more abundant species such as the bottlenosed dolphin and the short finned pilot whale can also become endangered if any structural social patterns were disrupted. This could result from such an occurrence as the destruction of the herd leader.

In the case of endangered species of marine mammals, any contamination by oil of an individual and the subsequent harm incurred would be detrimental to the population of that mammal.

Pinnipeds (Seals, walruses, etc.)

There are no known breeding sites for pinnipeds in the South Atlantic area. Occasional strays of California sea lions and harbor and hooded seals have been reported. The sea lions and harbor seals are coastal species, while the hooded seal is indigenous. Should oil spills occur as a result of the proposed sale, individuals of those species could be affected. Because of their habitat, sea lions and harbor seals would be most impacted by nearshore pipeline or tanker spills. Hooded seals could be impacted by spills in offshore oil-producing areas or offshore tanker spills.

Various impacts to pinnipeds have been reported from previous spills. Brownell (1971) and Le Boeuf (1971) investigated the effect on marine mammals of the Santa Barbara oil spill. Numerous dead animals found after the spill, including grey, sperm and pilot whales, dolphins and elephant seal pups. They were examined histologically and chemically for the presence of oil or pathological effects related to oil. Deaths were not directly attributed to the oil spill. It was also noted that the number of deaths was not abnormally high. However, Connell (1973) analyzed the data of Brownell and Le Boeuf (1971) on the mortality of sea lion pups and showed dead pups had more oil on their bodies than one would expect by chance.

Evidence of eye damage as a result of the oiling of pinnipeds has been shown. Nelson-Smith (1973) reported ". . . after the Arrow spill in Nova Scotia, young grey seals were found blundering about in woods half a mile from shore, unable to find their way back because of oil around the eyes and nostrils . . ." Pearce (1970) reported the rescuing of a blind female during a fuel oil spillage.

Sirenians (manatees)

The Florida manatee presently is concentrated in the areas around Florida where the water is warm. The critical habitat areas of the manatee are primarily in the intracoastal waterways and rivers. During the winter months they concentrate near power plant outfalls. The oil spill trajectory, autumn conditions (Section III., Figure A-8) indicates that the projected route could go towards the critical habitat areas of the manatee. If an oil spill were to occur at this time habitat loss could result which would result in the depletion of the food supply for this species. It is not known if the manatees would be able to find sufficient food or if they would consume vegetation that has been contaminated with oil. If they could not find sufficient food they might leave the area. If these animals ingested contaminated vegetation, the microflora and fauna of the digestive tract could be effected. Build-up of petroleum hydrocarbons in various tissues could also result. There is no data presently available to answer these questions.

Another threat to the existence of the manatee is increased harbor transportation. Any increase in shipping will have a toll on the existing manatee populations around the harbors. Each year there is a loss of manatees due to wounds inflicted by the propellers of boats. If development on the OCS occurs any increase in shipping traffic could increase the death toll of the manatee.

6. Impact on pelagic birds

The greatest impact on birds will be from accidental discharges of oil during drilling and production, from pipelines, and by intentional discharge from tankers. The probability of one or more spills greater than 1000 bbls. impacting on pelagic bird rookeries in the South Atlantic have been estimated as approximately 8-9%.

Although mass fatalities are often observed after spills of crude and heavy fuel oils, it has been estimated that only 5-15% of those birds actually killed by oil that is washed ashore where the death toll is taken (Nelson-Smith, 1973). Nevertheless, estimates for some spills are 3686 fatalities for the Santa Barbara blowout (Straughan, 1972), and 7000 for the San Francisco spill of Bunker C (Chan, 1972; Boesch et al., 1974). A more recent incident occurred on February 10, 1976, when an oil spill from sunken Stewart Petroleum Company barge was discovered off Smith Point, Va., in the Chesapeake Bay. Seepage from the sunken barge continued for several weeks eventually resulting in a spillage of 250,000 gallons of heavy tar-like oil (Kiernan, 1976). The spill killed an estimated 10,000 birds wintering in the Bay. Approximately 95% of birds killed were grebes and old squaw ducks. According to F&WS the remainder were loons, canvasbacks, redheads, whistling swans, buffleheads, Canada Geese, ruddy ducks, mallard, and teal. Secondary mortalities included ring-billed gulls and herring gulls which had fed upon the oiled waterfowl. Another 118,000 gallons reported still missing was apparently congealed at the bottom of the Bay.

The immediate effect of oil on birds is the fouling of their feathers. Clark (1969) reports that feathers become matted together and the repellant and insulation properties are lost, as well as their buoyancy. Birds can lose their ability to fly (Erickson, 1963), diving ducks lose their ability to dive for food (Chubb, 1954), or they become so soaked they drown (Tuck, 1960). Hartung (1967) reports that heavily oiled ducks lose more than twice the normal amount of body heat due to the breakdown of the insulating properties of plummage. To compensate for the additional loss, they develop very high metabolic rate which often leads to accelerated starvation. Ingested oil is lethally toxic to birds and often results in inflammation of the digestive tract or disturbs other physiological processes (Boesch et al., 1974). One study showed that seawater-adapted mallard ducklings ingesting 12.5 ppm (lowest level tested) of crude oil demonstrated a diminution of intestinal mucosal transfer rate of NA^+ and water thus diminishing the amount of water available to the organism (Crocker et al., 1974). The study further postulates that dehydration resulting from impairment of mucosal transfer mechanism may be an important factor contributing to the high mortality among oil-contaminated seabirds.

It is thought that some species of sea birds are more prone to oiling than others. Previous reports and observations have shown that diving birds suffer the most direct fatalities whereas others, such as gulls and shearwaters, suffer the least. Reports indicate that the vulnerable species are those that are attracted by slicks and consequently land on them. Bourne (1968) suggests the explanation that oil makes the water calm, or resembles food or tide rips, or shoaling fish associated with the presence of food. He also observed that swimming birds do not notice slicks until they come in contact with them and are consequently trapped. While some species, such as gulls fly away, others such as murres, dive beneath the surface. Surfacing into the slick would be fatal as was observed for alcids killed during the Torrey Canyon spill.

Not all birds are equally vulnerable to oil slicks. Clark (1971) reports that in Western Europe, auks, puffins, razorbills, murres, and other sea ducks suffer the most fatalities as a consequence of spills. Boesch et al. (1974) report that from the Santa Barbara spills, loons and grebes, which account for 7-10% of the total bird population suffered 64% of the mortality. A main concern is that many sea birds are long lived and breed slowly which can make recovery of a population very difficult if populations are reduced to a small size. Along the South Atlantic coast the bird species that are considered most vulnerable are the common loon, canvasback, redhead, whistling swan, mallard and ruddy duck.

The treating of oil contaminated birds had met with only limited success with the survival record being very dismal. According to Boesch et al., (1974), most birds perish soon after capture while others do not survive the cleaning procedures or the following recuperation period. The use of harmful detergents, improper feeding and handling of the treated birds are thought to have been responsible for the failure of early attempts of treating. Boesch et al. (1974) however, reports that established British centers with trained personnel achieve nearly complete survival of treated birds. The pelagic birds believed to be most susceptible to contamination by oil at sea are: gannets, phalaropes, aegus, alcids, boobies, shearwaters, petrels, gulls and terns.

Activities associated with pipeline burials, drilling, and construction of onshore facilities can affect bird populations in both offshore and onshore environments. If pipeline burial and drilling activities should resuspend toxic elements as metals and pesticides, they can enter food chains to affect bird populations (Appendix I). Onshore impacts from onshore activities that can occur are loss of habitats and other environmental disturbances for species that nest in marshes. The extent of the impacts would depend on time of year and where they occurred. If the facilities are constructed in marsh areas the habitat destruction could effect such species as the white ibis and great heron. The change in air and water quality and noise level can also effect these bird species during construction and development.

The time of day, season of the year, and sea conditions all play important roles in the bird species that occur in a specific area and the probability that they could be impacted by an oil spill. Spills occurring in the migration periods of spring and fall and wintering periods would probably impact the greatest numbers and kinds of birds. The South Atlantic States is the wintering area for many species of pelagic birds and waterfowl. Currituck and Pamlico Sounds in North Carolina are the major wintering areas for such species as the Greater Snow Goose and the Whistling Swan and the east coast of Florida is the wintering area for the Lesser Scaup. If an oil spill were to occur and wash ashore the probability of it reaching Currituck or Pamlico Sound would be about 23%. Since the sea conditions are most severe during the winter months this would be the most susceptible time for a spill to occur. If an oil spill occurred from an offshore platform, pipeline or tanker, it would require about 29 days for the oil spill to reach shore provided no clean-up was attempted. This type of oil spill would affect mainly the offshore diving bird species, (Argo Merchant Oil Spill, U.S. Dept. of Comm., March, 1977).

If a spill occurred from a nearshore pipeline or tanker, the oil could wash ashore within a short period of time (1 to 5 days) reducing the effects of dispersion, evaporation, and biological degradation. This type of nearshore spill would affect a much larger number of bird species.

Considering the 25 year estimated field life of this proposal and estimated 85% probability of one to five spills greater than 1000 bbls. of oil there could be a considerable impact on bird species within this South Atlantic region. The number and species of birds affected is difficult to predict because of numerous environmental variables (i.e.

location, volume, and type of spill; species present in area, weather conditions; season of year, etc.).

Bird mortalities attributed to some selected oil spills are:

(1) Santa Barbara Channel (January, 1969) 3600 birds (Straughan, 1970).

(2) Chesapeake Bay (February, 1976) 250,000 gals. of Bunker-C oil, 10,000 to 31,000 birds (Commonwealth of Virginia, 1976).

(3) Argo Merchant (December, 1976) 7.7 million gals. of No. 6 fuel oil; 540 waterfowl (U.S. General Accounting Office, 1977).

(4) Ekofisk Field platform "Bravo" (April, 1977) 6.3 million gals. of crude oil, no estimate (U.S. Dept. of Interior, 1977).

7. Impact on the live bottom areas

Offshore oil and gas drilling effluents that may be expected to have an effect upon live bottom communities include drill cuttings and drill muds (Section III.A.1.). Live bottom areas in the Gulf of Mexico typically occur in banks elevated generally 30 meters or more above the seafloor. This morphology is not necessarily found in the Southeast Georgia Embayment. The live bottoms of this area, in many instances, occur on relatively smooth seafloor or in depressions and are widely distributed. Therefore, the live bottom communities of the South Atlantic OCS area are probably more susceptible to impacts resulting from the discharge of drilling effluents than those of the Gulf of Mexico OCS area.

Impacts on the associated ichthyofauna are evaluated in Section III.C.6.

The sessile benthic organisms upon which the cuttings pile will slowly accummulate will be buried by the approximately (391 m^3) of cuttings generated by drilling a well (Section III.A.1.). These cuttings, if limestone, may form a low mound or if clays, may be dispersed over the live bottom area. Their fate is dependent upon the nature of the cuttings, nature of the local sediments, depth of disposal, benthic fauna capable of bioturbation, and/or encrustation, and the physical factors acting upon the cuttings pile. The effects on the nekton associated with live bottom areas is discussed under III.B.4.

The drilling fluids (muds), which are associated with the cuttings when they are disposed of overboard, are washed from the cuttings and eventually settle to the bottom after generally a wide dispersal through the water column. Jones and Williams (1973) found sediment barium concentrations to be above normal in areas of the Gulf of Mexico where intensive drilling has taken place. Barium sulfate is the major constituent of drilling fluids and the distribution of barium in the sediments suggest that the above-normal concentrations are due to the disposal of these fluids. Barium sulfate is a highly insoluble, nontoxic salt which is present in seawater at a concentration of approximately 0.05 mg/1 and in certain localities concretions and nodules of barium sulphate are found in bottom deposits (Horne, 1969); therefore, no direct toxic effects on benthic biota are expected from the disposal of drilling fluids during the exploratory, development, or production phases.

The field development phase will require the placement of platforms and the drilling of up to 20 wells from each of a maximum of 25 platforms. Initial platform placement and anchoring will crush or smother members of the epifaunal community in the immediate vicinity. Longer term effects may include a change in the live bottom community to reflect the presence of an artificial reef.

The drilling of 20 wells will result in the disposal of approximately 7,820 m^3 (10,228 yd^3) of cuttings which, in this area, are expected to be mainly carbonate in nature. This may result in the establishment of a different benthic community in the immediate vicinity of the cuttings pile.

The production phase will result in the introduction of the soluble components of crude oil at an average concentration of 30 mg/1. Due to mixing energy and the water depths in the proposed sale area, this effluent is expected to have no direct toxic effects on members of the hard bottom community. However, low levels of petroleum hydrocarbons have been shown to impair chemoreception in specific crustaceans (Blume et al., 1973): therefore, if this effluent should result in enhanced hydrocarbon concentrations in bottom water and if the indigenous crustaceans are susceptible to chemoreceptive interference, then an unknown degree of failure may occur in behavioral responses mediated by chemical stimuli. No research has been conducted which would more clearly resolve this issue or determine the magnitude of the problem if a problem exists. Bacteriocides are often added to drilling muds and completion during development

and production phases, and some loss of animal life can be expected, because of toxic effects. However, due to the small amounts of bactericide introduced and the great volume of the water column immediately under the drill structure, the toxic substances would be diluted to a concentration much weaker than those reported as the minimum toxic limit. An adverse impact however, would be at the water entry point of the drilling fluids where the concentration of toxic substances would be instantaneously high. Probably only surface planters would be affected, as more motile organisms would avoid the plume, and it would be diluted before it reached the bottom.

The transportation phase may require the installation of pipelines. If so, certain impacts to the marine benthos will occur.

In water depths of less than 61 m, new common carrier pipelines are entrenched by jetting away the sediment or cutting a trench beneath the pipe and allowing the pipe to settle into the underlying trench at least 0.9 m (3 ft). Partial burial takes place quite rapidly as the disturbed sediments slide and settle back into the trench.

Recolonization rates would be dependent upon seasonal reproduction cycles and recolonization by indigenous or other species. No accurate estimate of the time required for this to occur can be made at present.

The Bureau of Land Management recently published regulations pertaining to the protection of coral on the OCS (Federal Register, September 16, 1976). The regulations state that no person shall engage in any operation which directly causes damage or injury to a viable coral community that is located on the Outer Continental Shelf without having obtained a permit for said operation. Since there are a number of hard bottom communities in the lease area which may contain corals, many petroleum development related activities could come under the provisions of these regulations if this sale is held.

A new law, P. C. 94-265, the Fishery Conservation and Management Act of 1976, will cause the management of coral to fall within the purview of the various Regional Fishery Management Councils established by the law as soon as management plans are developed for coral. In the meantime, the BLM regulations will remain in effect in order to insure the protection of this natural resource.

The aggregate effect upon hard bottom communities from all of the above activities will be:

1. The introduction of an estimated total of 164,220 m^3 of drill cuttings, given the assumption that 420 wells will be drilled in the area to an average depth of 3,048 m. This volume of cuttings could potentially cover an area of 164.22 ha to a depth of 10 cm.

2. Potential impairment of the chemically cued interactions of the biotic components of the hard bottom ecosystem.

3. A potential increase in the barium sulfate content of the sediments immediately surrounding each production platform.

4. A potential temporary disruption of hard bottom communities along pipeline routes in the event pipelines are used for transportation.

8. Impact on Offshore Water Quality

The pre-exploratory phase of operations will have minimal impact on water quality in the planning area. Overboard discharges from the survey vessels are the only potential effluents and these effluents are infrequent and very low in volume.

During exploration and production the discharge of drilling mud and cuttings could result in minor water quality degradation. It is estimated that between 162,000 to 459,000 tons of drilling muds would be discharged over 25 years. These muds are primarily composed of barite, bentonite and other inorganic compounds. It is estimated that between 162,000 to 459,000 tons of drilling muds and 245,000 to 692,000 cubic yards of drill cuttings would be discharged over a 25 year period (this is based on drilling to 18,000 ft). When the mud and cuttings are discharged a turbidity plume is created. A turbidity plume from a drilling rig can extend well over a mile in length. The exact extent of these plumes will be determined primarily by the prevailing currents. The prevailing currents and winds will allow for mixing and dispersion of the turbidity plume. Zingula (1975) reports a rapid decrease in suspended solids, no appreciable change in pH and undetectable changes in soluble barium and chromium during drilling activities offshore Louisiana. See Table B-1. Ray and Shinn (1975), working in clearer waters confirm these observations. Their samples, however, were taken at 36 m and 75 m while the discharge occurred at 11 m. It is estimated that between 162,000 to 459,000 tons of drilling mud and 245,000 to 692,000 cubic yards of drill cuttings would be discharged over a 25 year period (this is based on drilling to 18,000 ft).

Table B-1. Analyses of samples collected January 9, 1975, by R.P. Zingula et al., at and around a well being drilled at Exxon's South Timbalier Block 54-E platform (From Zingula, 1975).

Sample No.	Description	Measured pH[1/] on-site	Measured pH[1/] lab	Suspended solids, mg/l	Soluble[2/] Barium	Soluble[2/] Chromium
1	Drilling mud from mud tanks under the shale shaker	8.48	8.5	350,000	0.5 ppm	0.2 ppm
2	Mud at downpipe at water surface	8.42	8.5	278	"	"
3	Water at center of muddy stream at sea surface, 100 yd downstream from downpipe	8.42	8.6	40.7	"	"
4	Surface water at center of muddy stream 1/8 mi downstream from downpipe	8.43	8.6	5.5	"	"
5	30 ft. below sea surface at location of sample 3	8.20	8.4	1.5	"	"
6	30 ft. below sea surface at location of sample 4	8.18	8.4	1.1	"	"
7	"Clean" seawater at sea surface, 100 yd. upstream from downpipe	8.45	8.6	5.2	"	"
	Spersene solution[3/] (lab.)	----	3.1	231	---	11,400 ppm

1/ Samples taken at 8-8:30 a.m., January 9. Onsite pH measurements made at 10-10:30 p.m., January 9. Lab measurements made January 13 & 14.

2/ Measurements of soluble chromium and barium were by atomic absorption, calibrated against a standard. Concentrations were below the limits of measurements of the system, i.e., 0.5 ppm barium and 0.2 ppm chromium.

3/ Spersene solution was made by mixing two aprts water with one part spersene by weight and letting stand for 24 hours.

The field development phase will have the same impacts as the exploratory phase only spatially more concentrated. An additional impact may be the potential temporary resuspension of bottom sediments during platform placement.

The production phase results in two pollutants for which the U.S. Environmental Protection Agency has seen fit to establish effluent limitations. These include oil and grease from produced water, deck drainage, muds, cuttings and sand removal; and residual chlorine from sanitary sources. Oil and grease may be discharged at an average concentration of 30 mg/1 and would consist of the soluble components of crude oil. This would be immediately diluted to 30 parts per billion when mixed with 1 m^3 of sea water. The impact of such a receiving water concentration on water quality would be minimal. Support services may generate minor discharges of bilge and sanitary wastes.

Tanker discharge, oil spills, and formation water dischargers would be the major causes of water quality degradation related to oil and gas development in the South Atlantic area. An estimated 4.6 million barrels of crude oil could be lost to the environment during the 25 year expected life of the field. This would be an estimated 1.6-0.5% of the oil that is expected to be produced in this area. The majority of the oil that might be spilled results from tanker operations and accidents. In view of existing tanker pollution in the area the percentage increase of oil spilled would be less than 0.001%.

The use of pipelines as a mode of transporting oil or gas that may be discovered could result in localized water quality degradation due to sediment resuspension during pipeline construction and burial. The jetting away of the substrate from beneath the pipeline will result in the suspension of sediments which may be rich in pollutants, especially in near shore areas adjacent to industrial development. As the width of the trench varies with the compactness and fluidization point of sediment, we can only estimate the volume of disturbed sediments. If the trench is roughly two meters deep by two to four meters wide, and a parabolic cross-section is assumed approximately 1,400 to 3,800 cubic meters per km would be removed, some of which would be resuspended. The turbidity plume will move downcurrent from the operation and can reach proportions of several yards wide and hundreds of yards long if the substrate is exceptionally muddy. The duration of the plume depends on the particular size, shape and density of the material suspended and the water turbulence. This increase in turbidity will create a short-term impact on water quality and may degrade water quality in coastal areas.

In summary the offshore water quality is most likely to be affected by drilling mud and cutting discharge, accidental oil spills and resuspension of bottom sediments during pipeline laying.

As indicated the turbidity plume that results from the discharge of drilling muds and cuttings is localized and short-term. This would therefore not lend itself to any severe water quality degradation problems. Accidental oil spills can also result in water quality degradation, however, over the projected 25 yr. period an estimated 4.6 million barrels of crude oil would be lost to the marine environment, mostly from tanker accidents. Therefore, this sale alone would actually only contribute less than 0.001% of the estimated oil spilled during the 25-year period. The resuspension of sediment in the laying of pipelines is localized and lasts only for a short duration. Other offshore operations such as discharges from survey vessels, deck drainage, sanitary wastes from rigs would be so minimal that they would not cause any water quality degradation.

In view of the fact that the offshore impacts on water quality would be localized and short-term there would not be any cumulative impacts if there were future sales in this area or in the Mid-Atlantic region.

9. Impact on Offshore Air Quality

Degradation of offshore air quality will occur in cases of oil spills, oil or gas blowouts, pipeline breaks, and the normal exhaust of platform generators and service vessels. The number of installations which will increase and then decrease over the expected 25-year development period probably will not exceed 31 widely separated installations.

If natural gas is related via a blowout or pipeline break, methane, ethane, propane, hydrogen sulfide, and other toxic gases will be released into the atmosphere. The percentage of each is difficult to predict since the character of the gas is not known at present. If the gas burns when released, carbon dioxide, sulfur oxides, nitrogen oxides, and carbon monoxide are produced. Although the exact quantities in-

troduced during the course of these accidents cannot be predicted, the resulting pollutants will be borne away by the prevailing winds and diluted in a very large air mass.

If a blowout should occur at a gas well and did not burn, the above gases in a comparable ratio would be released into the air. A typical offshore well produces approximately one million cubic feet of gas per day. A blowout could reasonably be expected to release at least this much gas into the atmosphere. However, if the gas well were burning, combustion would be essentially complete and the emissions would consist almost entirely of carbon dioxide (CO_2), water and any sulfurous gases would be oxidized to SO_2. It is difficult to predict the probability of this occurrence. Since essentially all of the components of natural gas are non-reactive, there would be little impact whether or not they are burned. Any impact that could result would be dependent upon how far away the incident is from the receptor and upon meteorological parameters.

If a blowout at an oil well occurred and released crude oil into the water, the resulting impact would be substantially greater. If the oil does not burn, a significant amount of it would evaporate. Almost all of the lighter fractions which have boiling points lower than that of $_{N}$C-12 (216°C) evaporates over the life of the spill. Evaporation introduces hydrocarbons and the volatile products of the reaction of sunlight and oil, and of microbial degradation activities into the atmosphere. If the oil burns when released, carbon dioxide, sulfur oxides, nitrogen oxides, carbon monoxide, and other partially oxidized material will be produced. Some of these, sulfur and nitrogen oxides, can cause problems by increasing the acidity of rain in the area. Other partially oxidized materials can cause smoke or haze problems. Although the actual extent of the effects caused by the addition of these pollutants cannot be determined beforehand, air quality will deteriorate in the areas affected by the spill or the associated air mass until the fire is extinguished, the spill dispersed, and the pollutants diluted. Any impact that could result would be dependent upon how far away the incident is from the receptor and upon meteorological parameters.

A reasonable estimate of the range of emission, assuming complete combustion, that an oil well fire could produce per 1,000 bbls burned, might be as follows (Levorsen, 1958, 1958); CO_2, 340,000-347,000 lbs., SO_2: 620-34,000 lbs., and NO: 660-10,000 lbs.

Combustion of oil would be incomplete; however, emissions would contain a smaller amount of the above compounds, and would include such materials as volatilized petroleum, particulate carbon, carbon monoxide, nitrous oxide, sulphur monoxide, along with other altered or partially oxidized matter. There is no reliable way to predict in advance the relative volumes of each of these possible emissions from incomplete combustion because it would depend, among other things, upon moisture content of the air, wind speed, pattern of oil spray from wild wells, number of wells involved, chemical content and physical character of the oil itself, and types of equipment and materials other than oil that might also burn.

The exhaust from the large electric generators on the platforms will contain particulates, sulfur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons which would be dispersed by the prevailing winds and rapidly diluted in the South Atlantic offshore air mass.

The air movement in the southeastern U.S. are predominantly northerly winds that move generally seaward (Sec. II.D.2.). The characteristics of these wind patterns indicates that the emissions from offshore facilities would be diluted in the air mass and transported seaward.

In summary offshore air quality will not be degraded as a result of the proposed sale. The largest volume of emissions would result from an oil or gas well blowout. Emissions from electric generators on the platforms would add only a minimal amount of pollutants to the air. Any emissions would be rapidly dispersed by the seaward wind patterns.

There would not be any cumulative effect on offshore air quality as a result of this sale or any future sales in the area.

C. Offshore Impact of Oil and Gas Operations on Human Utilization of the Environment

1. Impact on Ports

During the exploratory phase of sale related operations activities related to servicing offshore facilities may be expected to develop in several of the ports of the South Atlantic. Three of these ports are Charleston, Brunswick, and Jacksonville. These are all ports within relatively short distances from the major proposed leasing areas, facilitating crewboat, workboat, and helicopter travel to offshore facilities. These ports will receive a positive economic impact by the increased useage of industrial land and structures which may be presently vacant, under-utilized or marginally used. Economic development in the ports will progress due to the establishment of the new industry, and additional business will accrue to industries which are presently located in the ports. Since these three or any other ports will not necessarily contain the same set of service facilities, the level of impact may not be determined at this time.

It is anticipated that production from this proposed sale would replace a fairly small percentage of the foreign shipments of crude entering the U.S. There would therefore be an impact on those ports in the U.S. presently importing foreign crude oil. The levels of the impacts on individual ports should be small as the reduction in imports will probably not fall on any single port. Since none of the ports along the South Atlantic coast are crude importers they should not be affected by a decrease of foreign crude importation. If, however, a refinery were to be built at one of the South Atlantic ports for the purpose of refining imported foreign crude, this sale could result in a relatively minor negative economic impact at that port, if the sale produced petroleum were piped in as there would be a reduction in the need for towing, supply and other tanker servicing facilities.

Should it be decided to use tankers to transport the petroleum produced by this proposed sale, a relatively small number of tankers will be needed and therefore the impact on ports from tanker traffic will be minimal. Using the USGS figures of 56,000 barrels per day production low estimate and 179,000 barrels per day peak production high estimate and using tankers of 25,000 dead weight ton size, approximately one tanker per day would be needed for the high estimate production to be moved to port. In the low estimate situation one tanker would be needed approximately every three days. It is doubtful that such a small increase in tanker use of the ports would have a noticeable economic impact.

2. Impact on Shipping

It is expected that during the first phase of any development resulting from the proposal, there will be a negative impact on ship traffic both short term and disruptive in nature. Some conflicts may arise with cargo vessel movements caused by the additional number of vessels performing exploratory activities. In the process of performing seismic and other analyses, exploratory vessels will not be travelling in the customary directions, but will be criss-crossing some areas which could increase the possibility of vessel collisions. Many of these impacts would still be present during the development well drilling operations. Small craft providing shuttle runs between the coast and offshore sites for supply and work crew transport will cause an increase in ship traffic (5 to 10 vessels per day at the low estimate, 10 to 15 at the high) in the harbors and the offshore environment. Also during the development phase, there will be slow moving vessels and barges in the vicinity of laying and trenching operations of pipeline construction.

Any pipeline construction operations, which would be disruptive in nature, would terminate once the lines are completed. Trips by service vessels will continue throughout all phases of OCS operations. However, as exploratory and development related activities slow down, transport and service trips will decline. The production related trips—workmen transport, supply, and service—will become less frequent. These trips are primarily between onshore operation bases and offshore areas of oil and gas activities.

The overall effect on shipping is expected to be a minor negative one. The increased traffic of small supply and survey vessels, and pipeline barges will increase the number of vessels in the area at any one time. This will increase the hazard of collision and make navigation by large ocean-going vessels slightly more difficult than before development.

3. Impact on Navigation

As a result of the proposed sale, hazards to navigation would result from the presence of

offshore structures on the OCS during all phases from exploratory drilling to production. No navigational fairways (such as those in the Gulf of Mexico) are established for the South Atlantic OCS region. Vessels moving along the coast or towards the major ports described in Section II.G.1.a. travel generally to the best navigational and weather advantage to the vessel. Ships are not required to follow any lanes and may travel in any direction. Therefore any rig or platform set up in any of the tracts prepared for leasing could be considered a hazard to navigation.

Northbound traffic along the North American coast tends to follow the Gulf Stream in order to gain the advantage of the northward moving water. This would move these vessels generally seaward of the proposed leasing areas and out of conflict with activities related to the proposed sale.

Southbound vessels either cruise outside of the Gulf Stream or shoreward of it. Those traveling shoreward of the Stream may travel as far inshore as the proposed areas for leasing. For those vessels, the presence of rigs and platforms would constitute a hazard to navigation.

Vessels going into or moving out of any of the ports may travel through any of the tracts proposed for this lease sale. Any rigs or platforms placed in the sale area will therefore constitute a hazard to navigation.

There will be a positive impact, mostly for smaller vessels, as well lit, well identified platforms can be used as navigational landmarks.

At night and during bad weather, fog or heavy seas, ships navigating in the vicinity of structures could collide with them. If rigs and platforms, subsea completion systems of shut-in wells are located in present or future fishing grounds, fishing boats will be inconvenienced by having to detour around them.

Accidentally lost debris from platforms could also constitute a hazard to smaller vessels. Floating objects could foul propellers. The magnitude of the floating trash hazard cannot be determined.

Should collisions between vessels and offshore structures result, the impacts could include loss of human life, spillage of crude oil, or refined products, and the release of debris. Toxic contents of a ship's cargo could pose a threat to onshore and marine ecosystems.

Since there are no OCS-related offshore structures in the South-Atlantic, we must utilize the Gulf of Mexico experience in order to examine the incidence of vessel collisions with these structures. There were eight reported collisions between large vessels and offshore structures in the Gulf of Mexico between July 1, 1962 and June 30, 1973. These collisions include only those vessels over 1000 gross tons. These eight accidents accounted for $87,000 of vessel damage (only four vessels reported damage) and approximately $3.2 million in damage to platforms. No human injuries or deaths were reported. Five of these accidents occurred at night (three within two hours of midnight) and two during daylight. All of the eight major accidents occurred outside established shipping fairways and anchorage areas; only three were less than five miles from these established areas. At least five of the accidents involved foreign flag vessels.

The worst of these eight accidents occurred in 1967 when an 11,600 ton foreign flag cargo vessel collided with a platform during heavy rain, poor visibility, 45 knot winds, and 15 to 20 ft. seas. The vessel escaped with damages estimated at $12,000, but damages to the platform were on the order of $1.1 million or one-third of the total damages for all eight accidents.

The remaining 22 incidents of collision between vessels of less than 1000 gross tons and platforms caused more damage to the vessels ($426,000) than to the platforms ($102,000 which was relatively insignificant when compared to an average cost of $20 million per installed platform equipped with production machinery). Fifteen accidents including vessels less than 100 gross tons and the remaining seven vessels were between 100 and 650 gross tons. In all cases there was no loss of life involved.

More recently, in August 1975, there was a predawn collision between a British oil tanker and an unmanned platform under construction. The collision resulted in an explosion and the loss of six lives. A six mile long, mile and a half wide oil spill also resulted.

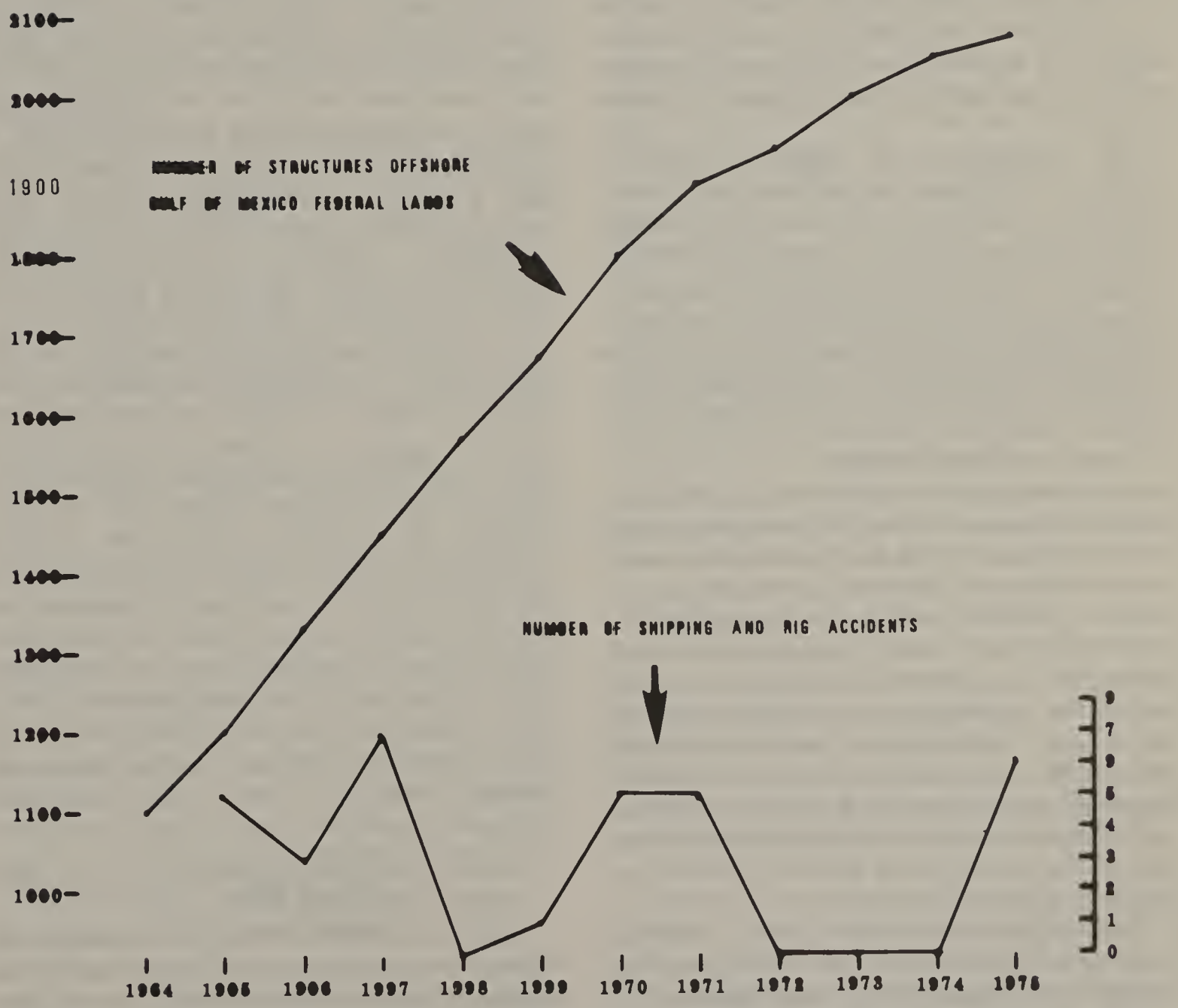
Figure C-1 shows the increase in the number of offshore structures versus the number of accidents involving these platforms in the Gulf of Mexico.

In the South Atlantic OCS area, as in any area, the most serious hazard involving offshore structures and vessels would be in the case of an oil tanker ramming a platform in such a way as to rupture the tanker and spill oil. The present

FIGURE C-1

ACCIDENTS INVOLVING VESSELS AND OFFSHORE STRUCTURES

SOURCES: USGS, USCG



probability of a tanker-platform accident is zero, but will increase an undetermined amount during the development and production phases if the proposed sale is held.

If oil produced as a result of this proposed sale is transported by tanker to shore, or by tanker away from onshore terminals, it can still be expected to replace shipments of foreign crude on a national basis. As none of the South Atlantic ports are major foreign crude importers the change in traffic caused by tankering South Atlantic OCS oil will be a positive one. Tanker traffic will increase, however, smaller vessels than those used in long haul transport would probably be used due to the small size of the ports. This will be an increase in vessel traffic which will develop fully only at the production stage and it will contribute to a somewhat greater incidence of vessel accidents and vessel-platform accidents within the region.

The establishment of navigational fairways would not bind vessels to stay within those lanes. Vessels are generally free to either use or ignore them at their own risk. The placement of rigs, erection of platforms and possible presence of tankers will inhibit this freedom of movement. A minor negative impact will result upon navigation in the sale area and traffic will no longer be as free from potential hazards as at the present time.

4. Impact on Ocean Dumping

Ocean dumping areas should not be directly impacted as a result of this proposed oil and gas lease sale. Figure G-3 in Section III depicts sensitive dumping areas in relation to lease sites.

The 17 interim dumping sites established by EPA in 1973 are at least 35 km inshore from offered lease tracts. Most all of these sites are intended for deposition of excavation or dredge matter (sand, shell, and silt). One 11 km^2 dumping site has been permitted for disposal of chemical industrial wastes in the OCS seaward of Savannah. This site is also sufficiently removed from offered lease tracts so as not to be directly impacted by lease site operations.

Wastes generated offshore as a result of offshore operations include spent drilling mud and cuttings, waste paper, plastic, metal, garbage, etc. When not disposed of offshore (drill cuttings, for example, reintroduced into the marine environment when determined to be environmentally acceptable by the Federal Government) wastes are transported back to shore for reclamation or disposal at local incinerators or landfills. Waste generated onshore as a result of industry support needs in the South Atlantic area (construction sites, personal waste of immigrants) is not projected to be dumped in the marine environment.

Pipelines, should hydrocarbon finds require such, may eventually impact with established and former dumping sites. If such a case were to occur there would be a temporary resuspension of waste matter for the duration of the pipe laying.

Two former explosive dumping areas are located sufficiently seaward of the proposed lease tracts so as to be unaffected by any activities associated with oil and gas operations.

The waters seaward of the ports of Jacksonville and Charleston are former mine explosive areas. These areas have been declared safe and available for unrestricted surface use. An adverse impact may occur however should a subsea pipeline be routed through a former mine area. Proper survey and possible decontamination efforts would precede granting a permit for such a right-of-way. Additionally, impacting a former harbor protection mine area with an undersea pipeline would limit its future utility as a live mine area.

In summary, pipelines may indirectly and temporarily have a minor impact on established ocean dumping areas. This impact will not affect the utility or capacity of established ocean dumping areas. This impact will not affect the utility or capacity of established dump sites. Pipelines traversing former mine areas however, run a risk of ordnance hazard and limit the future utility of the mine areas for reactivation. Offshore and onshore waste generated by this sale in conjunction with sale 40 (Mid-Atlantic) will not noticeably affect established ocean dumping sites. Should hydrocarbon finds stimulate further leasing in this region increased construction and population may increase pollution to the marine environment within 10-20 years.

5. Impact on Military Uses of the U.S. South Atlantic Continental Shelf

Figure G-3, Section II provides a graphic relationship between offered lease blocks and designated military fleet operating areas. All lease blocks fall within the Jacksonville or Charleston military operating areas utilized by the Defense Department for training activities such as practice bombings; torpedo and air-to-surface missile

firings; aircraft carrier operations; and submarine maneuvers. All activities related to hydrocarbon exploration and development (drilling, production, operations, oil and gas transport) will conflict with the Jacksonville and Charleston operating areas.

Fifty-six tracts fall within the Charleston operations area. Fifty-one of these tracts form a contiguous 60 km² lease area which lies between warning areas 132 and 137 and five tracts form a contiguous block less than 35 km² within warning area 132 used for surface gunnery and air-to-air firings. The remaining 158 tracts form a large oblong core extending approximately 195 km in a north-south direction and 95 km in an east-west direction in the Jacksonville operations area. These same tracts fall within warning areas 157 and 158 B used for surface-to-air operation and missile firing.

Discussions between the Department of the Interior and the Department of Defense during the tract selection process have resulted in lease stipulations (Section IV.) aimed at avoiding conflicts between military and oil and gas operations. Stipulations recommended are designed to control electromagnetic emissions and boat and aircraft traffic which would interfere with DOD flight, testing or operational activities in specified warning areas.

In summary, exploration, development and attendant shore-to-tract and tract-to-shore operations by sea and air as well as transportation of crude products by sea or undersea which could result from this oil and gas lease sale will effectively remove a large section of the Jacksonville operations area and to a lesser extent portions of the Charleston operations area from military operations. This proposed lease sale in conjunction with Sale No. 40 (Mid-Atlantic) and scheduled future Atlantic hydrocarbon sales will likely restrict the training flexibility of the armed forces by reducing military flexibility and use of existing designated operating areas.

6. Impact on Commercial Fisheries

Offshore oil and gas operations can interfere with commercial fishing activities in three general ways: removal of sea floor and pelagic areas from use, underwater obstructions, and loss of catch due to presence of oil in water and/or flesh (also refer to Section III.B.3. and 4.).

a. Removal of sea floor and pelagic areas from use

The majority of shellfish (such as shrimp) and some finfish species are harvested by bottom trawls. Sites occupied by drilling or production platforms, attendant service boats and tankers would consequently interfere with fishing activities. Only 13 of the 225 tracts being considered for this proposed sale, however, are in waters as shallow as 20 m where some 70% of the trawling operations take place. If the structures employed are jack-up drilling rigs or permanent production platforms, the area of the sea floor removed would amount to approximately 0.8 to 2 ha (2 to 5 ac) for each structure; considering a maximum of 25 structures in the entire lease area, this would affect a maximum of 50 ha (124 ac). In deeper waters over 91 m (300 ft), a semi-submersible drilling rig with its anchoring system occupies up to 66 ha (162 ac) (assuming a 457 m (1500 ft) anchoring radius), giving a maximum of 1650 ha (4070 ac). However, it is estimated that a maximum of 133 to 530 ha (330 to 1310 ac) would be removed from commercial fishing temporarily at any one time, leveling off to a maximum of 101 ha (250 ac); this is based on 0.8 to 2 ha (2 to 5 ac) lost to trawling operations per platform, and 10 to 50 platforms, with 25 platforms considered to be the most likely figure. Actual area removed, will probably be much less (for range of facilities anticipated, refer to Section I.C.1.). Again it is noted that most of the trawling operations take place shoreward of most of the proposed lease tracts. Permanent production platforms may remain in place for 10 to over 20 years.

Seining (for menhaden, mullet, flounder, alewives, croaker, etc.) is also primarily a shallow, nearshore fishery in the U.S. South Atlantic area and platforms should present no interference. Fishermen in the Gulf of Mexico do not complain about oil platforms interfering with their seining operations as they do regarding trawl fishing; this may indicate that there is no problem involved.

Offshore rigs and platforms can also present navigational problems to fishermen. Boats engaged in trawling will have to navigate around fixed structures, and there also exists the possibility of fishing boats colliding with structures. A Coast Guard summary for the Gulf of Mexico for the period July 1, 1962 through June 30, 1973, reported 10 collisions of fishing boats with offshore structures, or approximately one per year on the

average. Total damage to boats amounted to $151,000 and damage to platforms $24,000.

B. UNDERWATER OBSTRUCTIONS

Underwater stubs, large pieces of debris, and unburied pipelines may, when snagged, cause damage to trawls and nets.

Proposed OCS Operating Order No. 3 requires that all stubs and subsea systems be . . . "removed to that depth below the ocean floor approved by the area Supervisor. . ." when a well is abandoned. If a well is to be temporarily shut down, a stub is left protruding above the ocean floor to facilitate re-opening the well. In this case, Coast Guard regulations require the stub to be marked by a buoy if the water depth is less than 60 m (200 ft) and that the buoy be lighted if the water depth is less than 26 m (85 ft).

Large pieces of debris such as equipment, piping, structural members, tools, and the like, may accidentally be lost off a platform or service barge, the frequency of which cannot be predicted. Losses off a platform may be located easily by divers and retrieved. However, if debris is lost off a boat or barge underway, the location may not be known accurately enough to allow its subsequent recovery. Depending on the size and weight of items lost in this way, varying amounts of damage could be done to trawling nets, but this is expected to be very small during normal operations.

C. LOSS OF CATCH DUE TO OIL CONTAMINATION

Offshore oil spills have their most serious environmental effect within the upper few meters of the water column (Lassiter, Powers, and Devanney, 1974), although under strong wave turbulence oil has been driven as deeply as 50 meters (Forrester, 1971). The organisms most susceptible to mortality from an offshore oil spill would be those organisms occupying the upper layers and which exhibit little or no directional movement. Actively swimming organisms could be expected to swim away from the slick.

Commercial fishing grounds in the South Atlantic have a 95-97% probability, depending on the development scenario assumed, of being impacted by one or more major oil spills (over 1000 bbls each) sometime during the development of this area. Commercial scallops, crabs, and oysters have a 43-65% probability of impact; white, brown, and pink shrimp have a 62-69% probability; while bay scallops have only a 6-7% probability of impact from such a spill. Fish populations and distribution can become affected from four causes if such impact occurs:

(1) If large amounts of plankton or other assemblages that fish populations are dependent upon for food are destroyed, the food web could be seriously disrupted and result in population declines of organisms directly or indirectly dependent upon them.

(2) Entire year classes of larval or juvenile fish within the contamination area might be destroyed in a given area possibly resulting in reduced yields several years after the spill. For a further discussion of food webs, see Appendix I.

(3) Oil pollution might lower organisms' resistance to disease and other environmental stresses. This could produce an increased mortality rate over a long period of time causing a slow but marked decline in fisheries within an area that had been contaminated. Ketchum (1973) showed that abnormal development occurs following longer periods of exposure to concentrations as low as 0.01 ppm.

(4) Fish may have to be discarded due to tainting of the flesh. One example was given by Connel (1971), who stated that the Australian mullet had a kerosene-like tainting due to the presence of kerosene-like hydrocarbons in the flesh. He found the contaminated compounds to be similar to substances isolated from river sediments. Shipton et al. (1970), through gas chromatography and spectral analysis, reported that the isolated kerosene appeared to be similar to a commercial sample of kerosene. Liver examination by light and electron microscopes revealed higher amounts of free fat than untainted samples (Vale et al. 1970). Seatrout and plaice were found to be tainted as determined by taste tests. These fish were caught after the Torrey Canyon incident involving the spillage of Kuwait crude oil. No chemical analysis by chemical class was reported (Clark, 1973).

Numerous studies on the effects of oil on commercially important shellfish indicate that these invertebrates may both absorb and, to varying degrees, clean themselves of hydrocarbons. These effects are further discussed in detail in the section discussing the impact on the benthos (Section III.B.3.) and in Appendix I.

Oil spills can have both short- and long-term impacts on commercial fisheries. Oil spills may physically prevent fishing in contaminated areas.

Adult finfish, although they may not be killed outright, may suffer a long-term decline if food webs are interrupted and resistance to disease and environmental stress is lowered. Larval and juvenile fish can also be killed in great numbers which may result in greatly reduced yields several years after the spill, particularly for species which may be overfished. While many fish and shellfish may not be destroyed, they may be tainted with hydrocarbons and be unmarketable. This is very unlikely in offshore or nearshore areas, however, due to the dilution factor. Thus, the various shell fisheries such as that for the surf clam are relatively safe from these effects. However, shellfish in enclosed areas may be more susceptible due to their filter feeding characteristics and their inability to escape. Furthermore, there is some indication that oil contamination may interfere with reproductive behavior in some shellfish. If this is generally true, such contamination may have wide implications not only to the shellfish industry but to other fisheries which depend on shellfish in the food web.

If an oil spill were to occur the impact to the offshore fish populations would be greatest immediately after the incident. It is at this time that the most toxic elements are present. The boundaries of a particular spill are difficult to project; however, the immediate area of the spill would have the greatest impact. Some of the abundant species according to landings that are represented in the proposed leasing area are menhaden, flounder, spot, alewives, mullet, seatrout, croakers, and sea bass. Other species that are not as abundant but have a high market value in this proposed leasing area are pompano, snapper, hogfish, and groupers.

Many species spawn within the marshes and estuaries and spend their juvenile stages there. However, some species spawn offshore and the larvae and juveniles are transported to the estuaries. Some of these are menhaden, flounder, sea bass, and shrimp. The season when spawning occurs varies according to species; menhaden and croaker spawn during the fall and winter while snapper and scup spawn spring and summer. Therefore, the season in which the oil spill occurs would affect different species. Larval stages of marine organisms are generally considered more sensitive to oil pollution than adults (Kuhnhold, 1970). If an oil spill were to occur at the time of spawning, this could result in a death of the larvae in that particular area. However, since the range of these fish is vast, the total impact on the species would be minimal.

The calico scallop is of special interest in the southeast Atlantic because of their value as a commercial fishery and their life cycle. It is believed that the stock of calico scallops that are found off the North Carolina coast are recruited from larvae spawned off the coast of Florida and carried north by the Gulf Stream. Therefore, this larval transport system, which traverses the proposed lease area and connects the Floridian fauna the more northward fauna is likely to be impacted from the proposed sale (Barber, 1976). Larvae that come in contact with an oil spill would be killed.

The matrix indicates that for offshore structures there are 17 tracts that would have a maximum, 145 moderate, and 63 minimal potential impacts. In regard to the potential impacts on commercial fisheries as a result of oil spills, 5 have been designated maximal, 52 moderate, and 169 minimal. The maximum potential impact by offshore structures on commercial fisheries are tracts: 94-96, 104-106, 119-121, 131, 132, 144, 145, 163, 164, 171.

The tracts which will have a maximum potential impact on commercial fisheries due to oil spills are: 94, 104, 131, 132, 144.

The probability of an impact on commercial calico scallop grounds ranges from 7 to 32 per cent, depending on the production area or transportation route selected as the site of the hypothetical spill.

According to oil spill risk analysis data presented in Appendix M, there is a mean frequency distribution of slightly less than four major spills (>1000 bbl) during the life of the oil field (25 years). It is further estimated that there is a 74% chance that at least one major spill would come ashore in northeast Florida sometime during the life of the oil field.

The bays and estuaries are important spawning and nursery areas for many finfish and shellfish species. The southeast Atlantic coast is rich in shellfish nursery areas. Every bay and estuary along the southeast Atlantic coast has a potential for crab, shrimp, and oyster production. Bay scallops are found in shoal areas of Core and Bogue Sound. The probability of impact on this species is less than four percent depending on the route of the hypothetical oil spill. Albemarle Sound,

North Carolina, is a principal spawning area for striped bass and herring. In the spring these anadromous fish enter the estuaries and rivers to spawn.

The effect of an oil spill in any confined body of water along a tanker route may be expected to have similar actions upon the fish population, although the species composition may differ among the bodies of water. Thus, all life stages of fish could be seriously affected by an oil spill. Fish eggs and larvae would be killed by exposure to the oil film at or near the surface. Benthic fishes could be exposed to oil-laden particles which settle as a consequence of the high turbidity waters found in estuaries. Spills may have serious effects upon these local populations. However, the effect upon the total population along the Atlantic coast is largely speculative. Most species are distributed along a rather broad geographical range and a serious spill within a single bay may not have any significant effect on the total population.

Authors disagree on the time required for shellfish to cleanse themselves once the source of contamination is removed. Estimates vary from several months for complete depuration to no depuration after six months in clean waters. Conclusive data is lacking for many individual species at this time. However, some cleansing does take place in some species while in others it does not. The probability of an oil spill impacting white, brown and pink shrimp ranges from 25-35 percent depending on the route of the hypothetical spill.

A major impact will occur if a large oil spill reaches shallow water where it would affect benthic organisms (shellfish) or if it reaches the estuaries which, as nursery grounds, constitute a vital habitat at some stage of the life cycle of most commercial species of fish and shellfish. Areas of high sedimentation rate, which include such estuarine areas as well as important shrimping grounds, have a 55-62% probability of impact from a major oil spill, while marshes and wetlands, which also serve as nurseries for commercially important fisheries, have a 14-17% probability of an impact at least once during the life of the field.

Overall, the potential removal of ocean bottom from trawling operations, estimated to be a maximum of 530 ha (1310 ac), the effects of boats and seining operations, and the effects of obstructions do not appear to impose major consequences on commercial fishing operations; effects will be felt locally by individual fishermen if such structures are placed in areas they prefer to fish. Oil spills could both contaminate and destroy some fishery resources periodically. However, it is believed that any such impact will be of short duration and that quantities reaching such areas will not be great.

In the past several years shrimp has been the most valuable (in terms of dollars) of the commercially harvested fishery resources in the South Atlantic states. According to Calder et al (1974) there are three major stocks of these *Penaeus* shrimps, the pink, brown, and white.

The pink shrimp stock apparently is endemic to North Carolina and adjacent waters, whereas the white and brown shrimp are quite migratory.

Based on the information presented by Calder et al (1974), in order to substantially reduce the fishery, the shrimp must suffer heavy mortalities throughout their range, that is the continental shelf from mid-Florida to Virginia. It does not appear to be in the realm of possibility for an oil spill of this magnitude to occur. Localized seasonal reductions of the fishery would probably result in the area of any major oil spill. This would result either by mortalities or tainting of the flesh rendering the shrimp unmarketable.

The effect on the economy would be similar to those caused by natural fluctuations in abundance. For the economy to be impacted to an extent greater than that caused by natural fluctuations in abundance, localized depletion of the fishery would have to occur in several sequential years. This would require several years of consecutive oil spills in the same geographic location, and the probability of this occurring is very small.

From available evidence, it does not seem likely that commercial fisheries industry will be negatively impacted from oil and gas activities in this area.

The cumulative consequences of this potential sale, plus any future sales that might occur in this same area, combined with sales in the Mid-Atlantic areas to the north, would increase the severity of the impact on the commercial fisheries resources described above. However, due to the distance between the Mid-Atlantic lease areas and this one (about 500 miles as presently constituted), the effects of the two areas on commercial fishing are not expected to influence each other. Expanded development in the South Atlan-

tic would increase the risk somewhat. However, fishery resources would be more greatly affected. The probability of impact on scallops, crabs, and oysters, already high, would be increased by additional sales in the area. It must be remembered that the probabilities represent the chances of the oil reaching the resource but do not address the severity nor the duration of the impact. Because of the distances and times involved, it is believed that while such an impact may have severe local effects, the overall impact on the fishery will be temporary and will not contribute to a decline of the resource.

7. Impact on Offshore Cultural Resources

Offshore cultural sites such as known or undiscovered shipwrecks or prehistoric living sites could be impacted by a number of operations carried out in relation to the proposed sale. The placement of drilling rigs (jackup rig legs or mats, drillship or semi-submersible rig anchors, and the actual drilling equipment), pipeline burial operations, and the construction of terminal, storage or pumping facilities all may cause damage or destruction to cultural resources. Operations which place objects on the ocean floor could crush the fragile wood remains of historic ships. Operations which disturb the bottom (drilling holes, setting anchors, burying pipelines) can also destroy or damage all or parts of prehistoric living sites by moving artifacts out of their proper sequence, lifting objects from the protective mud or sand cover and allowing them to be moved by currents, and by actually damaging or destroying artifacts and ecofacts. Unless a magnetometer survey is done of an area prior to the placement of a pipeline or platform, the magnetic signature of a slightly scattered shipwreck could easily be either totally hidden by the much larger anomaly caused by the more modern structure, or the anomaly might be easily interpreted as part of the magnetic signature of the platform or other structure.

Should oil spills occur, and should some of the oil sink to the ocean bottom due either to natural processes or cleanup activities, cultural resources could become coated with oil. The removal of the oil during salvage could destroy or damage the cultural resource, and the presence of oil residue in organic artifacts or ecofacts could negate their being dated by carbon dating procedures.

Therefore activities related to this proposed sale could adversely affect some cultural resources such as submerged early Indian sites or sunken historical vessels, on the OCS. However, it is also possible that a beneficial impact could occur if new cultural resources are discovered during pre-operation surveys or during operations.

Shipwrecks: There is only one known shipwreck in the blocks proposed for leasing in this sale. A wreck of presently unknown age or character is located in Brunswick Area, Block 1006. The areas proposed for leasing are generally outside of the highest known concentrations of shipwrecks, however our very incomplete knowledge of the location of shipwrecks, especially older vessels leaves the possibility of there being an unknown wreck in any of the proposed blocks. Until there is a comprehensive evaluation of the cultural resource potential of the lease tract areas and potentially affected OCS zones been determined little is known on how this proposal may affect historic shipwrecks. Should the alternative discussed in Section VIII requiring a tract specific cultural resource survey be adopted the potential for impacting historic shipwrecks would be minimized. Should pipelines result from successful exploration, projected landfalls as described in alternative scenarios would generally be in the historic port cities such as Charleston and Savannah. Should this occur, the potential for impacting historic shipwrecks would increase significantly from pipeline construction activities.

Pre-Historic Living Sites: No pre-historic living sites are presently known on the South Atlantic OCS. Until there is a comprehensive evaluation of the cultural resource potential of the lease tract areas and potentially affected OCS zones have been determined little can be known on how this proposal may impact pre-historic living sites. As in the case of shipwrecks, potential for locating inundated early man living sites increases substantially in the vicinity of major riverine areas. Therefore, oil and gas activities impacting upon drowned river channels have a greater chance of affecting vestiges of former civilizations.

The extent and magnitude of the destruction of cultural resources, should any occur, is extremely difficult to determine. Due to the relatively small amount of the Atlantic Ocean floor (up to 105 ha (260 ac)) to be disturbed by petroleum activities resulting from this proposed sale, there is little potential for destroying undiscovered cultural

resources on the South Atlantic OCS, thus the resulting impact can be considered minimal. In the future additional impacts can be expected to be added on to those of this sale as further exploration and development takes place in the area. Should pipelines be brought onshore, or oil and gas development occur nearshore (within 3 mi) negative impacts might increase on shipwrecks as the concentration of historic shipwrecks gets heavier closer to the coastline along the Atlantic Coast. The distribution of drowned pre-historic living sites is presently unknown, however it is known that they probably do not extend further out than the maximum exposure of seabottom during the Pleistorene, probably between 40 and 60 meters. Should later development take place further out into the ocean than those depths, there would be no additional impacts on living sites.

The impacts from this sale will combine with those of other sales along the Atlantic Coast (Mid-Atlantic) to increase the potential for impacts on cultural resources. However, since the precise location, identification and classification of shipwrecks and pre-historic living sites is unknown on the South Atlantic OCS and a comprehensive evaluation identifying broad sensitivity zones is not available, the potential impact on cultural resources of this proposed lease sale considered alone or in association with pending and planned future sales is purely speculative.

D. Onshore Impact of Oil and Gas Operations on the Natural Environment

1. Impact on Beaches

The activity which would affect beaches in the planning area, other than a major oil spill, may occur in the transportation phase of development (Section III.A.3.). The importance and location of beaches is discussed in the description of the environment (Section II.F.1.) and the impact of spills on beach recreation is analyzed in Section III.E.6. If pipelines are needed to transport production, then a beach crossing may be necessary. Two to four pipeline landfalls could result from this proposed sale.

As the pipeline approaches the beach, there is a transition from burial by jetting to burial by dredge, either bucket, clamshell, or suction dredge. As this operation crosses the beach, it will disrupt and rework the sand for a width of 10 to 15 m, possibly killing the indigenous beach fauna. A period of at least one year will be required for the disturbed intertidal zone to return to normal.

Above the high-tide line, devegetation will occur along the pipeline right-of-way. Small dunes appear to recover within a few years after the installation of pipelines. Large, primary dunes will surely require much more time. These processes of dune reconstruction can be accelerated by planting of dune vegetation, such that dune communities can be expected to recover within a few years to soil, plant and animal conditions similar to an undisturbed, small dune (Willingham et al., 1975). According to the hypothetical case presented in III.A.1.e., pipeline landfalls will occur in Charleston County, S.C. and Duval County, Fla. In each case approximately 500 meters of beach and dune ecosystem will be crossed resulting in the disruption of 0.75 hectares in each case. Therefore, pipelines constructed as a result of this proposed sale should have a minimal impact on beaches.

According to the oil spill risk analysis developed for this area (USGS Open-file Report 76-653), the probability of impact on sandy beaches is high, ranging from 60 to 93%. The effect of oil on the beach biota would depend in large part upon the degree of weathering previously undergone. If the oil arrives on the beach as particles of asphalt-like material with little toxicity, the effects will be minor. Should unweathered oil contact the beaches, then the beach biota will be diminished by the death of those species to which petroleum hydrocarbons are toxic. If cleaning operations are successful in removing the bulk of the oil, then restoration should be rapid and complete within at least two annual cycles. If fresh oil is left on the beach, it will permeate the sand and cause erosion and will continue to leach out of the sand and be a source of chronic pollution for some time. According to the matrix analysis (Section III.F.) oil spills will have a minimal potential impact on these littoral systems. Therefore, the beaches in the planning area, particularly those of Florida, will be affected by oil spills. However, due to the residence time of the oil at sea, the effect will be primarily aesthetic.

2. Impact on Estuaries

The most likely potential impact to the estuaries of the planning area would result from a major oil spill. Pipeline activities could also result in impacts to these areas. The most evident impacts that could occur from offshore oil development would be those on pelagic and benthic estuarine life and on the salt marshes that surround the estuaries.

A. IMPACT ON PLANKTONIC AND NEKTONIC LIFE

The effect of spilled oil on these estuarine forms would be similar qualitatively to those described for pelagic marine life in the Atlantic Ocean in subsections B.1. and B.2. above. Although according to the oil spill trajectory model, the likelihood is quite remote, an estuarine spill would be worse for at least two reasons:

1) The estuary is a smaller, semi-enclosed body of water;
2) The larval and juvenile stages of many commercially and ecologically important fish species are spent in the estuaries and are therefore susceptible to a more severe impact. It has already been pointed out that larval stages are 10 to 100 times more sensitive to oil contamination than their adult counterparts.

One commercially and ecologically important nektonic estuarine species which would be adversely impacted would be the blue crab.

B. IMPACT ON THE ESTUARINE BENTHOS

Impacts would result from spilled oil and from pipeline burial. As with the planktonic and nektonic forms, we believe the effects on estuarine benthos would be qualitatively similar to those described for benthic communities of the open Atlantic in subsection B.3. above. Because of the limited quantities of water involved, and the semi-enclosed configuration, the impacts will express themselves more severely.

One unique feature of the estuarine benthos is the commercially and ecologically important oyster reef. Both commercial and non-commercial beds occur in the estuaries. Clams are often associated with the oyster reefs.

Oyster reef communities will sustain a significant impact in the event a massive oil spill penetrates an estuary.

Galtsoff (1959) noted that the major effect of industrial wastes and soluble components of crude oil is a reduction of the rate of various physiological functions, principally, ventilation of the gills. Specifically, these pollutants cause a reduction in the amount of time during which the oyster opens its valves for feeding and respiration. Pollutants also interfere with the coordination of the ciliary motion resulting in reduction of the pumping capacity of the gills. The reduction in feeding time (simultaneous with respiration) results in a lowered growth rate and poor quality oyster meats. It is well known that oysters can become contaminated with oil (Ehrhardt, 1972; Galtsoff, op. cit.; Mackin and Sparks, 1962) both from a massive spill and chronic low-level spillage. However, there is still a debate by several scientists as to whether the oysters can depurate when the water is again free of oil. Oil contamination imparts an oily taste to oysters, rendering them unmarketable.

The only other possible impacts could result if a pipeline were to be laid across an estuary. Because pipe burial produces roughly similar effects to routine navigation channel dredging or residential canals, literature on the former will be consulted in an attempt to predict the potential impacts.

According to Galtsoff (op. cit.), dredging activities are frequently harmful to oyster grounds. Dredging may adversely effect the oyster bottom in three different ways:

1) by changing the pattern of circulation
2) by smothering the grounds with sediments, and
3) by releasing toxic substances entrapped in the deep layers of mud.

The deposition of sediments stirred up by dredging and coastal construction is usually limited to a zone adjacent to operating sites. Dredging may, however, release the toxic substances accumulated for years in the mud of harbors and bays near industrial cities.

Due to various factors, it is difficult to state conclusively if the above discussed impacts will occur in all situations. However, any or all may occur during or after pipeline burial. According to the hypothetical case presented in III.A.1.e., pipeline landfalls will occur in Charleston County, S.C. and Duval County, Fla. If we assume that each pipeline will cross a maximum of 10 kilometers of the estuarine ecosystem, then we could expect the direct disturbance of approximately 60 hectares of estuarine habitat in each case or a total of 120 ha for the two pipelines. For a discussion of the technical aspects of pipelaying in estuarine areas and recovery estimates, see Section III.D.3.

c. Impact on Salt Marshes

The abundant salt marshes adjacent to the estuaries of the coast in the planning area would be subject to impacts resulting from sporadic accidental oil spills, from chronic oil pollutants, and from pipeline construction. Pipeline construction not only results in physical disturbance of the soil and vegetation, but also could allow the intrusion of saline water into brackish marshes. In the absence of tanker operations, accidental oil spills would be restricted to oil washed ashore from platform accidents or pipeline ruptures. Chronic pollution would result from pipeline leaking and refinery effluents. Drilling and production sites would not be a source of chronic pollution in the marshes since all proposed tracts are at least 40 km (30 miles) offshore.

Crude oil spills are the most likely adverse affect to occur in marshes as a result of this proposed sale. Studies on spills of Kuwait crude oil in the salt marshes of Pembrokeshire S.W. Wales were conducted by Baker (1971) and Cowell and Baker (1969), respectively. Baker (1971) reported that perennial marsh plants, e.g., *Spartina*, survived light to moderate single doses of oil sprayed in an experimental study. Annual plants were more severely affected if the oiling occurred prior to or during the flowering season, i.e., before the seeds were set in the sediment.

The crude oil spills at Pembrokeshire, from *Chrussi P. Goulandris* and at Cornwall from Torrey Canyon resulted in severe damage to the perennial plants. At Pembrokeshire the perennials, *Spartina* and *Puccinella*, showed at 75 to 100% susceptability to damage by crude oil. In some areas the damage to *Spartina* led to anaerobic conditions in the sediment. Some annual species were less abundant 6 months after the spill, but several

other anual species were undamaged or recovered rapidly. The filamentous green algae were seen to be very easily damaged, but they recovered rapidly.

Generally, it can be stated that for crude oil spills in marsh areas, the severity of the damages is contingent upon the distance the oil has travelled, the season of the year, the amount of oil, and the physiography of the area. *Spartina* is an essential organism to the salt marshes of the South Atlantic coast. Because of the apparent susceptibility of this group to damage by oil, it is possible that the marsh would suffer severe degradation due to impending anaerobic conditions and subsequent erosion of the sediment. The permanent damage to the marsh is dependent upon the recovery rate of the vegetation.

More insidious effects can be expected in areas of chronic pollution. Studies by Nelson-Smith (1970), Baker (1970) and Crapp (1970) on the salt marshes of South Wales showed that refinery discharges, even if in low concentration (10 ppm), in a matter of a few years, because of its continuous flow over extended period of time, will kill all the vegetation in the affected area. The damage *Spartina* is caused by the accrument of oil on the surfaces of the leaves which prevent the transfer of oxygen within the plant tissues resulting in severe oxygen depletion around the roots. The kiling of *Spartina* leads to the subsequent erosion of the marsh and the loss of a portion (95 acres in the Nelson-Smith study) of the marsh habitat.

The studies cited above suggested that marsh vegetation will usually, but not always, recover from acute oilings even though the initial impact is serious. Chronic oilings, however, are responsible for most of the degradation of marsh vegetation.

As discussed in subsection II.F.6., the salt marsh is the base for the food chain of the estuarine ecosystem, and damage to it would severely impact the estuary.

Estuaries and wetlands killed or extensively altered as a result of impacts from oil spills or other oil and gas related stresses can have adverse effects on stocks of anadromous fishes.

The type, extent, and timing of the occurrence of the stresses would probably produce different effects on the anadromous stocks. The impacts could be both direct (mortality and indirect habit destruction). The indirect impact would probably have the most profound adverse influence on the anadromous stocks.

If an estuary is so severely impacted that its productivity is drastically reduced, the dependent anadromous stocks would also be reduced. Anadromous fishes have the adaptive advantage of being able to survive in both fresh and saline waters, so some juveniles that would normally utilize the estuarine nursery areas would alternatively use some freshwater nursery areas. The freshwater regime cannot support as great a standing as an estuarine area can. Therefore, the recruitment from the freshwater nursery area would not be as great as that of the estuarine one, the end result being a smaller year class.

For species, with shorter life spans, successive years of small year classes could greatly reduce the stock size for that system.

Spills etc. that did not substantially reduce productivity would probably produce population fluctuations not inconsistent in magnitude with natural fluctuations.

Those mammals and birds subject to impact from an oil spill reaching the salt marsh environment would be: marsh rabbit, raccoons, mink, otter, rice rat, long-billed marsh wren, clapper rail and seaside sparrow. Other birds that would probably be impacted would be egrets, herons, rails, shorebirds and passerine species. Many species of diving ducks and other waterfowl also feed in the estuarine waters.

The estuary around Sapelo Island, Georgia, is one which provides a good example of a typical estuary along the South Atlantic coast. An offshore spill, if blown ashore, could be washed into the estuary through Deboy Sound and the tidal creeks and distributed over the salt marsh by the strong flood tide currents. Impacts to various members of the estuarine environment, as discussed above, would depend on the toxicity of the crude oil.

3. Impact on Wetlands

The transportation phase of development will affect the wetlands in the planning area if the need for pipelines arises and the pipeline right-of-way crosses this ecosystem type. The importance of wetlands and their location is discussed in the description of the environment (Section II.F.6. and 7.).

There are two basic methods of traversing wetlands with a pipeline. The "push" or "shove" technique is the preferred method because it tends to cause less impact to the environment, but

it is possible only where the marsh is firm. In this technique, a narrow, relatively shallow ditch is excavated by a dragline or clamshell digger from the bank. By using a marsh buggy base or by using runners or pads to spread the weight, the damage to the bank is minimized. The ditch may be 1 to 2 m deep by 2 to 3 m wide. The pipe sections are joined together at the point of origin of the ditch, the line given temporary buoyance by strapped floats, and pushed or shoved down the ditch. A section as much as 24 km long can be installed in this fashion. After being floated into place the floats are cut loose and the line allowed to sink to the bottom of the ditch. Typically, there will be approximately 1 m of water above the pipe. The ditch may be left open but is more frequently backfilled. Even with firm marsh, there is generally sufficient subsidence and shrinkage that the spoils will not completely fill the ditch. However, there usually is no canal after completion.

The second method of pipe laying utilizes a flotation canal to provide access for the pipe-laying equipment. Such a canal may be 12 to 15 m wide and two m deep, and may have an additional trench in the bottom to provide 3 to 4 m clearance above the top of the pipeline.

The pipeline is constructed on a series of lay barges and passed over the stern of the train. The pipe is large and heavy, and massive equipment is needed to manipulate it. For example, a standard 12 m section of 1 m diameter pipe weighs approximately 3629 kg. After the addition of a corrosion coating and 76 to 102 mm of concrete to give it negative buoyance, a 12 m section weighs about 15,419 kg. Equipment to handle weights of this magnitude cannot be supported by the marsh.

This type of canal is excavated by a flotation dredge, which normally piles the dredged material upon each side to form a low levee. Characteristically, where this type of canaling is carried on, the marshes are soft and unstable, sometimes to the point of being near-floating marshes.

Generally, the dredged material are piled back some distance from the canal to leave a 9 to 12 m berm between the canal and the levee. The levees are characteristically low and flat. Depending upon the width and depth of the canal (which determines the quantity of the dredged material) and on their stability, a levee may be 1 to 2 m high and possess a base width of 15 to 30 m. The high water content (50-80%) and the organic nature of the excavated muck leads to major shrinkage and subsidence when piled on top of marshland with similar properties. Height reductions of 50% are possible.

Because of these factors, there are never enough dredged materials from the excavation to backfill a flotation canal. Where canals traverse state-owned land or wildlife refuges, very stringent conditions may be attached to the right-of-way grant with the objective of minimizing impact on the territory, and these may include backfilling a flotation canal. In one recent example, nearly 3 km of flotation canal crossing a wildlife refuge were backfilled. However, as usual there was insufficient dredged material, and additional backfill (nearly 160,000 cubic yards) had to be dredged from a nearby bayou and lake. Backfilling with foreign material on a large scale is probably economically unfeasible, and the environmental impacts of the additional dredging required are unknown but probably significant.

In the course of laying such a line through marshland, numerous bodies of open water will also be traversed. The same equipment may be used, although only a trench will be dredged, or the assembled line can be jetted into place. Hydraulic dredged material may be pumped to nearby land, dispersed over the nearby area, or piled up to form an island, depending on the particular situation.

As with any major engineering effort there are a number of actions and effects from the general pipeline construction operations irrespective of the type of canal constructed. Either type requires surveying and an alignment established and marked. Marsh buggies have normally been used for this operation; these may have a permanent effect on the marshes, especially some softer ones. Even though wide tracks are used, and the unit pressure on the soil is low, the weak marsh structure is compressed and depressed tracts are left. These may not be self-repairing in some cases because of their depth, and may act as erosion foci.

Similarly, when bank-supported draglines are used to dredge push canals, the berm may be damaged, even when pads are used, if the marsh is soft.

In the construction of a flotation canal and laying of a pipeline, there also can be erosion effects upon the canal from the ancillary boat traffic bringing men and materials to the site but this is a short term effect.

Gagliano (1972) has identified several adverse impacts to marshes as a result of pipeline canal dredging. These include primarily the disruption of marsh vegetation, salt-water intrusion, accelerated runoff and increased tidal exchange. Any of these impacts have the potential to reduce a marsh's productivity or alter the floral and faunal components. The duration can be expected to be short-term (less than one year) if the area is rehabilitated upon completion of the pipeline. However, impacts could result for several years if no effort at reclamation is made.

Individual states will have a great deal to say about the location and type of pipeline construction. Proper planning on the part of the affected states will serve to minimize the impact on sensitive areas such as wetlands. Indeed, a state may decide to prohibit any such construction in wetland areas (see Section I.E.2.).

According to the hypothetical case presented in III.A.1.e., pipeline landfills will occur in Charleston County, S.C. and Duval County, Fla. If we assume that the flotation canal (worst case) method of construction is used, which results in the disruption of an approximately 65 meter wide zone, and that maximum of 10 kilometers or marsh mud be traversed in each county, then approximtely 65 hectares of marsh will be disrupted in each case.

According to the oil spill risk analysis prepared for this area (USGS Open-file Report 76-653), the probability of impact on wetlands is low, ranging from 3 to 7%. Wetlands in the proposed sale area would most likely recover from a single oiling.

Therefore, given the low probability of impact from an oil spill and the minimal number of pipeline traverses envisioned, the impact to wetlands from this proposed sale is expected to be negligible.

4. Impact on Vegetation

Coastal vegetation will be impacted by construction, both of pipelines and other facilities, and by oil coming ashore from an oil spill. If facilities such as refineries, pipelines, roads, are constructed they would probably be located in already developed areas. Also, any required pipelines will have to be carefully sited in order to minimize adverse impacts due to such construction. The Coastal Zone Management (CZM) programs of the South Atlantic states will play a large role in such siting; unfortunately, none of the South Atlantic states presently have an approved CZM program, so this aspect cannot be considered in more detail at this time.

Vegetation at the specific location of pipelines and other facilities will be destroyed, but the areas involved are so small as to be of little significance. Approximately 8 ha would be cleared for operation bases and 20 ha for gas processing facilities. More importantly is the case taken to insure that such construction does not interrupt or change to any degree water flow or drainage. If done, carefully, such construction will allow much of the native flora to return after construction, especially in pipeline areas.

Oil from spills reaching vegetation will have a severe adverse impact if the oil has recently been spilled and is fluid enough to coat the plants and kill them. While the analysis of oil spills from the lease areas shows a probability of 14-17% that oil will reach marshes and wetlands, it is believed that such oil will be weathered and dispersed to the extent of having little effect. More serious is the threat of an oil spill from tankers, dock facilities, or pipelines in close proximity to vegetation so that it is blanketed and killed by recently spilled fluid oil. The probabilities of this occurring at least once during production in this area approaches certainty, so some vegetation will be killed by oil. However, it is believed that such destruction will be limited in area and will recover quickly (within the next growing season), and that no species or populations will be entirely eliminated.

In summary, there will be an adverse impact on coastal vegetation due to oil and gas operations as a result of this proposed lease sale. The impact will be most pronounced in the event of an oil spill in the vicinity of vegetation. Overall, it is believed that the impact on vegetation resulting from this lease sale will be slight and short-term. Similarly, the effects on vegetation in the South Atlantic states from other sales, including potential future sales in the South Atlantic, are considered to be small and temporary.

5. Impact on Wildlife

a. BIRDS

The bird population of the Atlantic Coast is mainly comprised of migratory species. During the migration period, large populations are concentrated within specific U.S. South Atlantic areas. The most likely birds to be impacted are

shorebirds, waterfowl and predatory birds, although other birds may also be impacted. The Arctic peregrine falcon which is on the endangered species list has a migratory route that extends along the entire length of the Eastern Atlantic Coast. It has been estimated that there would be a 57 to 88% probability that an oil spill occurring within the proposed lease area could affect the migration routes of this species. There would be less than a 2% probability that an oil spill occurring in the potential production area would have an impact on brown pelican rookeries, bald eagle nesting areas or the dusky seaside sparrow habitat.

The migratory waterfowl are probably among the most susceptible due to their flocking habits and the large number of birds using the Atlantic Flyway. Large concentrations of these birds are often found in relatively small areas so that if a spill were to affect an area where the birds are congregated, high mortalities might be expected. Flocks of migratory waterfowl could be impacted during the spring and fall migrations. Also, many waterfowl winter in the U.S. South Atlantic area and therefore would be susceptible during the winter also. If oil should impact these areas, populations can be reduced through loss of habitat or direct fouling. It should be pointed out, however, that most of the refuges and other marshland areas are not liable to direct impacts from spilled oil during drilling or production activities, as most of them are situated within inlets or protected by barrier islands.

Marsh communities of coastal Georgia and to a lesser extent those of coastal North and South Carolina and Florida, might be especially vulnerable to spills from pipelines. Communities adjacent to tanker routes could be vulnerable to spills resulting from tanker accidents.

If a major spill should occur as a result of this proposed sale, habitats utilized by shore birds in the U.S. South Atlantic could be impacted. As Erickson (1963) reports, both habitats and food supply are greatly reduced by oil deposits. Many shore birds rely on intertidal areas which could be affected as a result of a spill. The long-term damage to bird habitats from chronic oil pollution at sea may exceed that caused by irregularly occurring major spills. Murphy (1971) suggests that all hydrocarbons do not degrade readily and carcinogenic ones may persist in the marine environment.

The treating of oil contaminated birds has met with only limited success with the survival record being very dismal. According to Boesch et al. (1974), most birds perish soon after capture while others do not survive the cleaning procedures or the following recuperation period. The use of harmful detergents, improper feeding and handling of the treated birds are thought to have been responsible for the failure of early attempts of treating. Boesch et al. (1974), however, report that established British centers with trained personnel achieve nearly complete survival of treated birds.

Activities associated with pipeline burials, drilling and construction of onshore facilities can affect bird populations in both offshore and onshore environments. If pipeline burial and drilling activities should resuspend toxic elements as metals and pesticides, they can enter food chains to affect bird populations (Appendix I). Onshore impacts from onshore activities that can occur are loss of habitats and other environmental disturbances. The extent of the impacts would depend on time of year and where they occurred. During the migratory or breeding seasons, OCS-related activities could affect bird populations if they should occur nearby. The long-term effects of pipeline burials are not known but are not expected to permanently damage bird habitats. Onshore facilities, depending on the type facility can impact bird populations if they are constructed in sites utilized by birds. If facilities should create changes, as in air and water quality, noise, and so on, they can affect surrounding populations.

In summary, activities associated with pipeline burials and construction of facilities can impact bird populations from disturbances these actions create and through loss of habitat. Disturbances associated with the construction stages are believed to be relatively short-termed and the extent of damage can vary. Loss of habitat due to placement of operation bases (20 ha) and processing plants (8 ha) is expected to be permanent.

The impact of oil on various species of birds is directly related to their behavior patterns and habitats on which they are dependent. Sea birds undeniably receive the greatest impacts, and mortalities can be high as previous cases have shown. Because of the location of proposed tracts for lease, these species would be most likely to receive impacts from an oil spill in the offshore U.S. South Atlantic. In some cases, populations

are suppressed for prolonged periods (Uspenskii, 1964). Onshore species can be impacted due to loss of feeding habitat and nesting sites and nests. These species are less likely to be impacted from an onshore spill. They could be impacted by pipeline leaks or breaks or by tanker accidents.

The time of day, season of the year, and sea conditions all play important roles in the species of birds that occur in a specific area, and the probability that they could be impacted by an oil spill. The Atlantic coast is an important migratory flyway for numerous species of waterfowl. Spills occurring in the migration periods of spring and fall and wintering period would probably impact the greatest numbers and kinds of birds. The Southeast Atlantic states is the wintering area for many species of birds. Currituck and Pamlico Sound in North Carolina are the major wintering area for such species as the Greater Snow Goose and the Whistling Swan. The east coast of Florida is the wintering area for the Lesser Scaup. If an oil spill were to occur and wash ashore in either of these areas the probability impinging on areas would be about 23%. Since the sea conditions are most severe during the winter months, this would most likely be the most susceptible time for a spill to occur. The impact of an oil spill from a platform, would be minimal since the expected time before the spill would reach shore is greater than 29 days provided no clean up equipment was used.

Some of the species believed to be the most susceptible to contamination by oil at sea that is found in the proposed area are common loons, grebes, scooters, and scaup. Species that are less vulnerable to contamination are the ring billed and great black beak gulls; gull billed, Forster's and Least terns; canvasback redhead and wood duck; Wilson's plover and American oyster catcher.

In summary some of the bird species that would be impacted are the common loons, grebes, scooters and scaup. Other species such as gulls and terns are less vulnerable to oil contamination. There is an 85% probability that from one to five oil spills greater than 1,000 bbls could occur over the field life of the entire proposed lease area (Appendix M). Should an oil spill occur in the South Atlantic region and drift inshore there would be an undetermined loss of coastal bird species which feed and/or rest in the nearshore areas.

B. OTHER WILDLIFE

The impact on terrestrial wildlife could be direct through habitat encroachment and oil spills and secondary through potential oil spill contamination of food sources.

Direct impacts resulting from construction as a result of the proposed sale would be the greatest on the small mammals, reptiles, and amphibians (distributions appear in Section II.E.2.b.) at construction sites. It is estimated that a maximum of 122 ha will be required for onshore construction. Currently the locaton of these facilities have not been determined, but probably they will be in areas which are already heavily developed and thus will have a minimal impact on wildlife. Pipelines, if constructed, will have an impact on presently undeveloped land and pipeline siting will have to be made with care. The extent of the impact would ultimately depend on habitat recovery (revegetation of the area) but should be limited in magnitude and of short duration. Only those individual animals having home ranges within or overlapping the actual zone of construction could be either destroyed or displaced. This zone could be narrow enough that the initial disturbance should extend little beyond it. There could be, however, a definite alteration of habitat within the construction zone. Whenever vegetation cover of habitat is rendered unsuitable for one animal community, it may be replaced by another community.

Any disturbance occurring due to local construction should have only a local and minor impact. This means that there should be little measurable indirect impact on the total system stemming from impact on small animals (mammals, reptiles, and amphibians). It is possible that a population occupying a small area could be eliminated, causing a greater adverse indirect impact, but no such populations have been identified.

There is potential for direct and indirect impact on both small animals and larger mammals and predators during any pipeline operation. There could be direct, adverse, short-term impact on small animals (mammals, reptiles, and amphibians) anywhere that an oil spill occurred or reached shore. The impact would depend on the location, the habitat, and the season of the year. It might range from minute to severe depending on the circumstances. There is insufficient information available to evaluate the long-term and in-

direct effects of oil spills upon small mammals. Shore areas most susceptible to spills would be along pipeline and tanker routes.

Through the beach and marsh vegetation and carrion links in the food web (discussed in Appendix I), it is possible that oil production could affect terrestrial mammals which either constantly or intermittently use habitats subject to oil pollution. Intermittently, deer and other foragers and rodents utilize beach and intertidal zone plants exclusively and would thus be vulnerable to the threat.

Ingestion of oil-covered carrion by foxes, skunks, and shrews would result in petroleum hydrocarbons being assimilated directly at the top of the food chain; however, the relative toxicity of crude oil to these mammals is not currently known.

The impact on beach-utilizing mammals of hydrocarbons that have become entrained in the marine ecosystems from chronic low-level sources is unknown. There is, however, evidence to suggest that chlorinated hydrocarbons which may be resuspended for a time in the water column could cause premature births in California sea lions with a resultant death of pups (Delong et al., 1973). Additional chronic low-level data is presented in Appendix I.

Some mammals could die from ingesting oil from contaminated pelage while grooming (Alaska, 1971). Scavengers such as foxes and skunks could occasionally eat oil-killed animals, and foragers such as deer could eat oil contaminated vegetation thereby ingesting petroleum. It is difficult to estimate possible losses since the effects on animals ingesting hydrocarbons is not well-known at present.

In summary, impact resulting from the burial of pipeline and construction activities will probably be of limited magnitude and of short duration. Species most affected by such construction would be those whose habitat would be destroyed by the construction. Oil spills reaching the shore will also have an impact on wildlife, but this impact is expected to be small because of the time it takes the oil to reach the shore and because the probability of the oil reaching areas of major wildlife habitat such as marsh and wetlands (14-17%) and wildlife refuges (8-9%) is relatively low (appendix n).

Oil and gas operations in Mid-Atlantic should have little effect on the South Atlantic coastal wildlife due to the distances involved (in excess of 500 miles). However, future South Atlantic sales will increase the risk since more oil will presumably be produced which will increase the risk of a major oil spill. Also, such future sales could increase the number of pipelines that will be built onshore, but the magnitude of such an increase is not known at this time. Increased tanker traffic may also result, which would increase the risk of an oil spill near the shore or in harbors, which would greatly increase the risk to wildlife in the vicinity of such a spill.

6. Impact on Endangered Species

The endangered species affected and the characterization of their habitat are discussed in Section II.E.2.e. Those onshore species liable to be impacted are the southern bald eagle, brown pelican, dusky seaside sparrow, Arctic peregrine falcon and Bachman's warbler. Adverse impacts may result to these species in ingesting oil contaminated food. The actual effects resulting from ingesting oil contaminated food are not currently known, but would certainly not be beneficial. A very remote possibility would be the ingestion of marine forms which incorporated pesticides or trace metals resuspended during drilling and dredging operations. Also considered remote is a significant reduction of food supply. Additional food chain data is given in Appendix I.

Another possible effect on these birds could be reproductive in nature. In experiments with mallard ducks, Hartung (1965) found that consumption of small amounts of oil disrupted egg laying activities. He also found that eggs smeared with oil had a very low hatching rate. This effect has been noted in osprey on Gardiner's Island, Long Island, but the small sample size and low reproductive success of the remainder of the colony makes it impossible to confidently state that oil was the cause of the failure of the eggs to hatch (Paul Spitger, Cornell University, personal communication, 1976).

Little, of the habitat utilized by these species or other endangered species is expected to be lost as a result of the proposed sale. As discussed in previous sections, most of the operations will be restricted to very small areas. Little habitat is expected to be lost to permanent installations. Possible problems OCS-related facilities may create and possible impacts are discussed in Section III.E.2.

Several colonies of the red-cockaded woodpecker have been identified in the coastal areas of the South Atlantic with the most significant populations occurring in Florida. Since this species is a resident of mature pine forests, it is somewhat removed from offshore leasing. Any primary impact from offshore leasing would result from habitat destruction caused by construction of onshore support facilities and this is not expected to occur in the red-cockaded woodpecker habitat.

The manatee's distribution in the South Atlantic region has changed little in recent years and peninsular Florida remains the focus of the species range with appearances in Georgia being relatively uncommon and exceptional in South Carolina. The populations tend to concentrate in select estuarine and river habitats that provide adequate vascular vegetation, recourse to warm water, a source of fresh water, and proximity to channels of at least two meters in depth.

Critical habitat as designated by FWS (41 FR 41916) for the Florida Manatee (*Trichechus manatus*) includes the majority of the larger freshwater rivers and their headwaters along both coasts of penisular Florida. Pursuant to Section 7 of the Endangered Species Act of 1973, all Federal agencies must take such action as is necessary to insure that actions authorized, funded, or carried out by them do not result in the destruction or modification of this critical habitat area.

An adverse impact to the species that could occur from offshore leasing is that of habitat destruction through water pollution and possible pipeline laying or onshore operations. The oil spill trajectory, autumn conditions (Section III, Figure A-8) indicates that the projected route could go towards the Florida coast. The majority of the Florida manatee resides in warm water in this area. If an oil spill were to occur during this season there would be a loss of habitat resulting in the depletion of the food supply for this species. However, it is expected that the currents and weathering would considerably dissipate an oil slick before it reached the manatee's habitat.

Increased ship transportation in harbors could also result in injury to the manatee. This would result in a decline in the manatee population.

In summary, both habitat destruction and increased ship traffic in harbors could result in an adverse impact on the manatee.

Alligators for all practicable purposes are coastal wide throughout the geographic area of this proposed sale. They are primarily a species of the fresh water environment, but occasionally inhabit brackish marshes. It is not expected that acute or chronic discharges of oil will reach their habitat should this sale proceed. The ingestion of oil-contaminated species is a remote possibility, but if it did occur, it is not expected that this would prove very detrimental for any length of time and would not affect the population as a whole.

The possibility of habitat destruction by allowing salt-water intrusion into the fresh water environment is also possible. However, this would be on a local basis and would not affect the total population to any extent.

Critical habitat as designated by FWS (41 FR 41915) for the American Crocodile (*Crocodylus acutus*) lies mostly in the Everglades National Park and keys in Biscayne and Florida Bays. The species depends on the quiet waters of Florida Bay and associated marshes for feeding and nesting. It is believed this area will not be impacted by offshore or onshore development as a result of this proposal because of distance from the proposed lease tracts (approximately 250 nautical miles) and its interior location.

Endangered sea turtles in the South Atlantic include the Atlantic ridley, leatherback and hawksbill with the loggerhead and green being classified as threatened. The principal impact that may affect the turtles as a result of offshore leasing is oil washing ashore and possibly contaminating the eggs or hatchlings on onshore installations destroying nesting areas. Individual turtles could be coated with oil if they emerged into an oil slick. Since sea turtles nest from approximately the first week in May through September with hatchlings emerging after a 60 to 70 day incubation, a spill inpacting a beach could affect sea turtles for up to seven months of the year. Sea turtles are air breathing animals and hatchlings frequently swim at the surface. Thus, an oil spill would undoubtedly affect them, as well as the forage items (small fishes and crustaceans) that make up the major portion of their diet.

The short-nosed sturgeon could possibly be impacted by habitat destruction through water pollution and possible pipeline laying operations. However, pollution from a lease site is considered remote due to the distance the tracts are from the

estuarine areas. Also, it is expected that the currents and weathering would considerably dissipate an oil slick before it reached the sturgeon's habitat.

The most destructive impact possible would probably be that of an oil spill reaching the shore or estuaries. As discussed in Sections III.A.4.5. and 6., this is not considered very likely. Thus, it is believed that impacts to endangered species as a result of this proposed sale would be a chance occurrence, temporary, and confined to specific areas, and a few individual animals so that only a small part of the population in question would be affected. However, the loss of even a small part of the population of an endangered species can be of major consequence to the survival of the species.

The Bureau of Land Management actively coordinates with the regional FWS, NPS, and NMFS offices pertaining to endangered species, critical habitats, and marine sanctuaries. This coordination process is conducted through the preparation and review of EIS's, requests for resources information, S.O. 2974 meetings, and special lease stipulations.

7. Impact on Onshore Water Quality

There are some water quality problems along the South Atlantic coast, especially in the urban centers of Charleston, N.C., Savannah, Ga., and Jacksonville, Fla. These areas also have a great number of discharges. Areas where the population and industrialization is low have good water quality. It is evident that in some of these urban areas the present waste water treatment facilities are being utilized to their fullest extent. Each state is in the process of developing water quality management plans that will identify problem areas and propose a possible solution that will provide adequate treatment.

Changes in the population and industrial sectors as a result of the possible discovery of oil and gas resources in the proposed sale area, would include changes in the water quality of onshore areas in excess of the changes that would occur due to normal growth and development. The largest impact would be on generation of nutrient phosphates and nitrates from municipal sewage, related to projected increases in population. The SEAS model indicates that the nutrient nitrates and phosphates would increase less than 6% during the peak years of production. This increase was only found in Glynn County, Ga. Maximum increases in population of approximately 5,600 to 10,800 persons, with no one county expected to receive more than 5,000 persons, are indicated.

An estimate of the degree of deterioration of water quality during peak production years due to the increase in population can be made by estimating the increase in sewage loadings. As a "worst" case situation for those areas considered most likely to receive a major portion of the development such as Charleston S.C.; Savannah, Ga.; or Jacksonville, Fla., the maximum increase of 10,800 persons will be used. This population change represents an increase in the BOD loading of 670,140 pounds/year, based on a figure of 0.17 lbs/person/day.

In order to estimate the impact of increased demand on existing water supplies, a figure of 1000 gallons/person/day will be used. This includes municipal, commercial, and industrial needs with municipal and commercial needs representing approximately 20% of the total and industrial needs the remaining 80%. Using the same maximum population increase discussed previously, the increased demand would be approximately 11 million gal/day. This increase would probably not result in the over burdening of local treatment systems since the population increase is expected to be distributed throughout the area.

The effects of increased population could result in an increase in loading for present treatment facilities that are already over loaded. Plans are presently being made by state water quality management boards to comply with the Federal Water Pollution Control Act by increasing present facilities capacities and building new facilities in areas such as Charleston, S.C., Savannah, Ga., and Jacksonville, Fla. New facilities or additions to present facilities should be in operation by July 1, 1977 before any impacts from this proposed sale would be felt.

Increases in most industrial activities would be less than one percent of the present industrial force. The exceptions would be the construction industry and the newly required gas processing industry. Gas processing plants use about 15,000 gallons of water per day and would not seriously affect the water supply of an area. Their contribution of water pollutants would be minimal (CEQ, 1973). With the introduction of natural gas processing plants there would be an increase in auxiliary industry such as industrial organic

chemicals and plastics. If this occurs there could be a more serious environmental problem even though these industries employ stringent controls. Any industrial expansion or development would fall under the EPA effluent guidelines for point sources and the water quality standards. These guidelines require the "best practicable" treatment after 1977 and the "best available" after 1983, which should prevent other than incremental deterioration of existing water quality. Pollution from non-point sources may be significant because of increases in construction activity related to the introduction of operation bases (20 ha) and processing plants (8 ha).

An increase in the volume of surface runoff and problems of turbidity and siltation in rivers, streams and estuaries would result from these activities. These impacts are considered most likely to occur in the rivers and near shore areas. Estimate of actual volumes are most possible at this time since the volume is a function of rainfall, slope, erosion control practices, etc. This impact would be short-term, occurring only during the development stage of these facilities.

The SEAS model indicates that if a refinery were constructed in the proposed area there would not be any significant increases in BOD and suspended solids, even if OCS development resulted in increased refinery activity.

Serious water quality degradation could occur within the vicinity of an oil refinery, especially if it were located near an estuary. The oil spill could result in the short-term deterioration and the closing of shell fish harvest areas. This problem would be highly localized near these facilities. Although the problem would be short-term, the results could be severe.

In summary, the water quality would not be severely impacted over the long-term as a result of the proposed sale. The population increases in the area would not result in any major increases needed for sewage facilities. Those facilities that are near or at capacity levels are presently upgraded and will sufficiently handle the minimal population increase. Construction of processing plants and operation facilities would result in only short-term water quality degradation due to runoff.

The development of gas processing plants would result in a minimal effect on the water quality. However, the operations of auxiliary facilities such as industrial inorganic chemicals and plastics plants could result in increased water quality deterioration over a short-term. Refineries would not seriously increase BOD or suspended solids in the water. The most serious problem is accidental oil spills from the refinery and terminal areas. This could severely degrade the water quality for a short-term in the near vicinity.

8. Impact on Onshore Air Quality

The general air quality in the study area is good. The highest pollution concentrations occur in the urban areas of Charleston, S.C.; Savannah and Brunswick, Ga., and Jacksonville, Fla. Most of the monitoring stations in the Air Quality Control Regions (AQCR's) are located in these areas indicating that they are the isolated problems. These urban areas are most likely to be areas for onshore OCS development and activities which further add to the present level of emissions. None of the monitoring stations in the Air Quality Control Regions (AQCR) indicate that the ambient air quality standards for NO_X and SO_X are being exceeded. However, for particulate matter several monitoring stations do indicate that the ambient air quality standards are not being met. This is mostly true of the urban areas around Jacksonville, Fla. and Savannah, Ga., where the levels were 21,607 tons and 48,444 tons per year, respectively. The Jacksonville, Florida area also has the highest levels of SOx being emitted 110,593 tons/yr, this exceeds EPA standards.

Changes in population and in the commercial and industrial trial sectors as a result of the possible discovery and development of oil and gas resources in the proposed South Atlantic sale area could induce increases in pollutant levels of particulate matter, SO_X and NO_X. Changes in population have a direct effect on the number of vehicle miles traveled (VMT) and on the volume of residential fuel needed. Changes in economic activity affect the levels of output and fuel use in the commercial and industrial sectors. The major pollutants associated with these sources are indicated in Table D-1. The Harris Model indicates that for the region as a whole, during peak production years in the mid 1980's the increases in population would be less than one percent in most commercial and industrial sectors. The urban areas that would most likely feel an impact are Charleston, S.C., Savannah, Ga., and Jacksonville, Fla.

Transportation also adds pollutants such as NO_X, hydrocarbons, carbon monoxide and par-

Table D-1

Sources of Air Pollutants

SOURCE	MAJOR POLLUTANTS[1]
TRANSPORTATION	
Personal (Automobile and Bus)	SP, SO_x, NO_x, HC, CO
Freight (Trucks)	SP, SO_x, NO_x, HC, CO
RESIDENTIAL FUEL USE	
Natural Gas	SP, SO_x, NO_x, HC, CO
Distillate Oil	SP, SO_x, NO_x, HC, CO
COMMERCIAL FUEL USE	
Distillate Oil	SP, SO_x, NO_x, HC, CO
INDUSTRIAL FUEL USE	
Coal, Gas, Oil	SP, SO_x, NO_x, HC, CO
ELECTRIC UTILITIES	
Oil	SP, SO_x, NO_x, HC, CO
INDUSTRIAL SOURCES	
Gas Processing	SO_x, NO_x, HC
Construction	SP
Petroleum Refining and Storage	HC
Others (Chemicals, Manufacturing)	SP, SO_x, HC
CONSUMER ACTIVITIES	
Dry Cleaning	HC
Painting	HC
Gasoline Service Stations	HC

[1]Suspended Particulates (SP), Sulfur Oxides (SO_x), Nitrogen Oxides (NO_x), Hydrocarbons (HC), and Carbon Monoxide (CO)

Source: EPA. 1975.

ticulates into the air. The majority of these emissions result from freight rather than personal vehicles. Small increases of 5% for hydrocarbons and 10% for carbon monoxide emissions was projected during 1988-1996 period. These impacts are brought about due to increased freight transportation activities from construction and other industrial activity related to the operation base. The increase of emissions by personal vehicles would be less than one percent for any given area. Gas processing plants, even with the various advanced treatment devices, add sulfur and nitrogen oxides to the air which cause odor problems and could increase the acidity of rain in areas such as Charleston, S.C.; Savannah, and Brunswick, Ga.; and Jacksonville, Fla. The extent of the odor problems, however, could depend on the quantity of sulfur in the natural gas discovered.

The largest impact on air quality would result from a gas processing plant. For the areas where operation bases with terminal facilities are constructed the impacts would be smaller. The potential impacts could result from an increase in NO_X and SO_X. The level of SO_X could result in 5% of the sulfur being emitted into the atmosphere as SO_X. This level would result in non-compliance with environmental standards. However, with further treatment 99.8% of the sulfur can be separated from the natural gas. This would result in less than a 2% increase in SO_X emissions, which would be stringently controlled. The SEAS model projects that the NO_X emissions would increase from 9% in 1988 to 22% in 1996 where a gas processing plant would be in operation. Since their control regulations for NO_X are not stringent, this could result in the deterioration of the air quality.

Another minor impact associated with gas processing plants is acidic rain, however, estimates cannot be made regarding the degree of possible impacts at this time. The results of the environmental study indicated that under worst conditions, high sulfur content of gas and 1971 control levels, rather than most stringent controls, a plant with a capacity of one billion cubic feet per day would emit up to 87,000 tons of sulfur oxides per year. This would be a significant load and would present the potential for increases in acidic rains. However, whether lower pH levels would actually occur would depend upon a complex set of variables, including the constituents of precipitation in the area. Much of the effect would depend upon the amounts of nitric acid in precipitation as well. Therefore, no prediction can be made as to whether a gas processing facility would actually increase the acidity of precipitation, or if it did, the areal extent of effect.

The effects of acid rain are not yet well understood. They may include changes in leaching rates of nutrients, acidification of lakes and rivers, effects on the metabolism of organisms, and corrosion of structures (Likens, 1974).

The exceptions are the anticipated increase in the levels of construction due to the need for onshore support facilities (20 ha), pipelines, access roads, and so on, and the development of gas processing plants (8 ha) where none existed before. Construction activity increases the suspended particulate loadings of the air which increases hazing and soiling. This would be a short-term impact and therefore would not seriously effect the general air quality in the area.

If an oil refinery were built in the South Atlantic, an increase in emissions would result in the vicinity. The estimated typical air emissions for an oil refinery complex are listed in Table D-2. The extent of any environmental impact depends on the different sulfur levels in the oil being refined. There would be an increase of at least 20% of all categories of pollutants with SO_X being the greatest at 10% if there was a refinery. This indicates that the air quality in the vicinity of an oil refinery would be seriously degraded.

In summary, air quality can be effected by population increases, construction of operation bases, and roads, transportation, both personal and freight, gas processing plants and oil refineries.

There is no significant effect on air quality due to population increase, construction activities, and transportation. The overall increase in population throughout the area is less than one percent during the peak years of production. Therefore, this would have little impact on the degradation of air quality. Construction activities would also add only minimal pollutants in the form of particulate matter into the air. This would be short-term and very little deterioration would occur. Transportation would increase in the area and hydrocarbons and carbon monoxide would be emitted. The major contributor would be freight rather than personal vehicles. Increases in HC and CO emissions should not be considered as serious because of projected stringent controls on automobiles and

TABLE D-2 Estimated Typical Air Emissions (tons/day)

Module	Particulates	SOx	CO	NOx	Hydrocarbons
1000-MBD Low Fuel Oil Refinery Complex	37.9	177.9	10.3	76.5	163.5
1000-MBD High Fuel Refinery Complex	31.9	154.4	10.3	64.9	166.4

Source: Arthur D. Little. New England Regional Commission Energy Program, Tech. Report 75-6 Petroleum Development in New England Vol. Three of Four Volumes.

trucks. The level of these emissions declines over time in relation to the base year. Therefore, relative air quality increases over time and small projected increases do not alter this pattern.

The development of a gas processing plant would result in some air quality deterioration. There would be a potential increase of 5% in SO_x emissions. Since further treatment of "sour" gas (gas that has a high sulfur content) is available a minimum increase of less than 2% of SO_x would result. Even if these stringent controls were not applied, there could be some deterioration in air quality due to the introduction of these plants.

The most serious air quality deterioration could result from the introduction of an oil refinery. These could be at least a 20% increase in all types of pollutants with SO_x being the greatest at 80%. This could occur in the vicinity of the refinery and could have a long-term effect on the air quality in that location.

It should be noted that the figures used in calculating the expected rates were on the high side and this would probably not be the case in this region. According to the SEAS model, the projected increases in industrial, commercial, and residential activity related to the hypothetical development of oil and gas resources off the South Atlantic would not create any significant environmental problems.

There would not be any cumulative impact as a result of this or future sales on the general air quality of the region.

9. Impact on Potable Water

Changes in population as a result of the possible discovery in the proposed sale area would result in increased demand for potable water.

The estimated peak increase in population in 21,000+. Average daily consumption is estimated to be 200 gpd/per person which would result in the demand for an additional 4.225 million gpd for the entire South Atlantic region.

Any increase in pumpage from the principal aquifer would tend to enlarge the present cone of depression such as at Savannah, Georgia, and would accelerate the brackish water's northward intrusion of the principal aquifer.

E. Onshore Impact of Oil and Gas Operations on Human Utilization of the Environment

1. Introduction to the Development Scenarios

Economic development scenarios prepared for this draft environmental impact statement include two base case scenarios without development on the Outer Continental Shelf (OCS) and five scenarios incorporating various hypothetical OCS development schemes. These scenarios are presented in detail in Appendix K, "Economic Study of the Possible Impacts of a Proposed Oil and Gas Lease Sale off the U.S. South Atlantic Coast".

Base I incorporates a projection of economic activity with no additional new refining capacity construction, and no development of oil and gas production on the OCS.

Base II incorporates as projection of economic activity without development of OCS oil and gas production, and with the addition and operation of a general purpose petroleum refinery in Chatham Co., Ga.

The scenarios incorporating the development of oil and gas on the OCS are numbered A, B, C, D, and E. Scenarios A, B, and C incorporate the low resource estimates provided by the Geological Survey (USDI-GS, 1976) and Scenarios D and E incorporate the high resource estimate.

Aside from the level of resource estimates, the principal differences between the scenarios occur in the areas selected as sites for facilities related to OCS operations.

Oil storage and handling facilities, and gas processing plants, were assumed to be located within the counties designated as landing points.

OUTLINE OF PARAMETERS OF DEVELOPMENT SCENARIOS

a. Scenario A incorporates the following locations for facilities:
   - Operations Base: Chatham Co., Ga.
   - Oil transportation: tankered outside area
   - Gas transportation: none

b. Scenario B includes the following assumptions:
   - Facility locations:
   - Operations Base: Chatham Co., Ga.
   - Oil transportation: by pipeline to Duval Co., Fla., then crude tankered to existing refineries.
   - Gas transportation: by pipeline to Charleston Co., S.C.

c. Scenario C includes the following assumptions:
   - Facility locations:
   - Operations Base: Chatham Co., Ga.
   - Refining location: Chatham Co., Ga.
   - Oil transportation: pipeline to Glynn Co., Ga., overland to hypothetical refinery in Chatham Co., Ga.
   - Gas transportation: pipeline to Charleston Co., S.C.

d. Scenario D includes the following assumed facility locations:
   - Operations Bases: Glynn Co., Ga.; Charleston Co., S.C.; Duval Co., Fla.
   - Oil transportation: by pipeline to Duval Co., Fla., and Charleston, S.C., crude tankered to existing refineries.
   - Gas transportation: by pipeline to Duval Co., Fla., and Charleston Co., S.C.

e. Scenario E includes the following assumed facility locations:
   - Operations Base: Glynn Co., Ga.; Charleston Co., S.C.; Duval Co., Fla.
   - Oil transportation: by pipeline to Chatham Co., Ga.
   - Gas transportation: by pipeline to Glynn Co., Ga. and Charleston, S.C.

Scenario D is deemed to be the most likely scenario, and is used as the basis for impact analysis in Section III.

The other scenarios are analyzed in Section VIII.

After discussions with representatives of the states involved in the proposed South Atlantic Sale 43 an interest was expressed by some of the state representatives in having a scenario which represented the maximum possible (although improbable) impact that might occur in their state. According six additional scenarios were formulated.

OUTLINE OF PARAMETERS OF ADDITIONAL DEVELOPMENT SCENARIOS

f. Scenario GASC incorporates the following locations for facilities:
   - Operations Base: Camden County, GA., Georgetown, Georgetown County, SC.
   - Refinery Location: Chatham County, GA. or Jasper County, SC.
   - Oil Transportation: Undersea pipelines to Charleston County, SC. and Glynn County, GA. and from these two locations to Chatham County, GA.
   - Gas Transportation: By pipeline to Charleston County, SC. and Glynn County, GA.

g. Scenario NC incorporates the following locations for facilities:
   - Operations Base: Duval County, FL., Clynn County, GA., and New Hanover County, NC.
   - Oil Transportation: By pipeline to Charleston County, SC. and to Duval County, FL. and then by tanker to outside refineries.
   - Gas Transportation: By pipeline to Charleston County, SC. and to Duval County, FL.

h. Scenario GMAX incorporates the following locations for facilities:
   - Operations Base: Camden County, GA.
   - Refinery Location: Glynn County, GA.
   - Oil Transportation: By pipeline to Glynn County, GA.
   - Gas Transportation: By pipeline to Glynn County, GA. and Camden County, GA.

i. Scenario FMAX incorporates the following locations for facilities:
   - Operations Base: Duval County, FL.
   - Refinery Location: Duval County, FL.
   - Oil Transportation: By pipeline to Duval County, FL.

Gas Transportation: By pipeline to two plants in Duval County, FL.

j. Scenario SCMAX incorporates the following locations for facilities:
Operations Base: Georgetown County, SC.
Refinery Location: Charleston County, SC.
Oil Transportation: By pipeline to Charleston County, SC. and Georgetown County, SC.

k. Scenario NCMAX incorporates the following locations for facilities:
Operations Base: New Hanover County, NC.
Refinery Location: New Hanover County, NC.
Oil Transportation: By pipeline to New Hanover County, NC.
Gas Transportation: By pipeline to two locations in New Hanover County, NC.

It is well to keep in mind that these scenarios are merely hypothetized situations or models but not predictions. They are intended to examine the possible impacts of both probable and improbable resource location situations. The following Table (Table E-1) compares the Harris Model scenarios (runs). For further discussion see Appendix K.

2. Land Use Impacts

Table E-3 presents estimated space and locational requirements for facilities which may be required as a result of this sale. Based upon USGS estimates of development needs for the low resource estimate, a total of 44 ha (110 acres) would be required for terminal, storage, and operation bases (Appendix B). The high resource estimate would require 108 ha (270 acres) for these facilities. It is assumed that no refinery construction will be induced in either case. If one each of the remaining facilities listed in Table E-3 were constructed an additional 14 ha (35 acres) would be required. It is expected that unused capacity in some existing facilities would be available (i.e. office space, trucking firms, machine shops) thus a precise estimate of space for new service facilities cannot be made. Even if multiple new facilities are required in some service categories the total area will not be large. Only operations bases, and a few small service companies which require docking facilities, would need to be located in the shore zone itself. While pipeline pumping stations need to be located in coastal areas, the storage facilities do not have to be located in coastal areas, but could be located inland from the pumping stations. Storage facilities are, however, normally located adjacent to the pumping stations.

Scenarios developed for Harris Model analysis, assume that operations bases may be located in Duval County, Fla.; Glynn County, Ga.; and Charleston County, S.C. An oil terminal was assumed to be built in either Charleston County, S.C. or Chatham County, Ga. It was further assumed that a gas processing plant would be located in either Charleston County, S.C.; Glynn County, Ga., or Duval County, Fla. Oil discoveries as a result of this sale are not expected to be sufficient to warrant the construction of an oil refinery in the region. If required onshore bases or oil storage terminals are located in areas where industrial land uses and vacant parcels of suitable industrially-zoned land exist, no adverse land use pattern changes should result. Similarly, if those developments should take place in areas where no industrial bases presently exist, but where developable land is available and such development is considered compatible, impacts would probably be positive. Adverse impacts to land use patterns could occur if such facilities were to be allowed in areas where industrialization or industrial expansion are not compatible.

Gas processing plants do not require coastal locations. They may be near or inland from pipeline terminals if gas and oil pipelines share corridors. Gas processing plants occupy relatively small sites and locational constraints are minimal. They could be placed in existing industrialized areas or in rural areas if local regulations allowed. Siting these plants in industrial areas near population centers could result in the need for incoming gas lines, as well as outgoing lines, to be odorized. The Department of Transportation, Materials Transportation Bureau issued new regulations (Amendment 192-21, Docket No. OPS-241, Federal Register, Vol. 40, No. 91, May 9, 1975) requiring odorization of transmission lines by class location, the class being determined by the population in the area. The expense incurred in this process may account for rural locations desired by industry. Increases are expected in existing areas of petrochemical activity, and incremental increases may result from sale related gas processing. As a consequence, it is not anticipated that gas processing plants will necessarily lead to development of associated petrochemical plants. Therefore, the siting of gas processing plants is not expected to lead directly to other industrial uses. However, to the extent that any industrial facility placed in a previously unindustrialized locality can lead to adjacent industrial land uses, gas processing facilities in such an area could stimulate adjacent industrial uses. In addition, gas

Table E-1

Comparison of Harris Model Runs

Runs	Resource Estimates	Base Used for Comparison	Refinery-Location	Resource Location	Onshore Gas Pipeline and Processing Plant	Onshore Oil Pipeline Terminals	Surface Transportation of Oil-Products	Overland Pipeline Routes	Operation Base Locations	Central Office Location
Base I	0	-	0	-	0	0	0	0	0	0
Base II	0	-	S	-	0	0	Crude & Products	0	0	0
Base III	0	-	J	-	0	0	Crude & Products	0	0	0
A	Low	I	0	Random	0	(Offshore)	Crude	0	S	S
B	Low	I	0	Oil-South; Gas-North	C	F	Crude	0	S	S
C	Low	II	(S)	Oil-South; Gas-North	C	B	0	B → S	S	S
D	High	I	0	Random	C,F	C,F	Crude	0	F,B,C	S
E	High	II	(S)	Random	C,B	S	0	0	F,B,C	S
GASC	High	II&III	(S) (J)	Random	C,B	C,B	0	B → S ← C	U,G	S
NC	High	I	0	Random	C,F	C,F	Crude	0	F,B,W	S
GMAX	High	I	*B	All-Georgia	B,U	B	Products	B	U	B
FMAX	High	I	*F	All-Florida	2-F	F	Products	0	F	F
SCMAX	High	I	*C	All-South Caro.	C,G	C	Products	0	G	C
NCMAX	High	I	*W	All-North Caro.	2-W	W	Products	0	W	W

S - Savannah, Chatham County, Georgia
J - Jasper County, South Carolina
B - Brunswick, Glynn County, Georgia
F - Jacksonville, Duval County, Florida
C - Charleston, Charleston County, South Carolina
W - Wilmington, New Hanover County, North Carolina
U - Camden County, Georgia (Undeveloped area)
G - Georgetown, Georgetown County, South Carolina

( ) - Refineries in parenthesis are not OCS induced.
* - In order to consider a maximum economic impact situation, OCS activity - induced refineries were hypothesized for the impacted states in these scenarios. However, such refineries are considered highly unlikely.

Table E-3 Estimated Land Use Requirements of Individual OCS Related Facilities[1]

Facility	Acres	Hectares	Locational Requirements
Onshore Operations Base[2] (Includes helicopter pads, warehouse space, small office and dockage)	50.0	20	Inland water docksite with ocean access, Atlantic shoreline not necessary; dockside able to accommodate drafts to 15 feet; industrial zoning.
Pipeline Shore Terminal (including storage facilities)	40.0	16	Rural area desirable; highway access.
Gas Processing Plant	20.0	8	Rural area desirable; highway and rail access.
Onshore Office	--		Rental space; metropolitan area.
Mud Supplier	4.0	1.6	Inland water docksite with ocean access; industrial zoning
Cement Company	5.0	2.0	Inland water docksite with ocean access; highway and rail access; industrial zoning.
Wireline Company	6.0	2.4	Industrial zoning; highway access.
Gas Lift Company	0.5	.2	Industrial zoning; highway access.
Logging and Perforating Company	4.0	1.6	Industrial zoning; highway access.
Rental Tool Company	3.5	1.4	Industrial zoning; highway access.
Wellhead Equipment Company	1.5	.6	Industrial zoning; highway access.
Machine Shop	1.0	.4	Industrial zoning; highway access.
Trucking Firm	5.0	2.0	Industrial zoning; highway access.
Supply Store	2.0	.8	Industrial zoning; highway access.
Downhole Equipment Company	2.0	.8	Industrial zoning; highway access.
Diving Service	0.5	.2	Industrial zoning; highway access.

1 Derived from information from the Offshore Operators Committee, an industry association, with the exception of acreage requirements for gas processing plants, which is from Resource Planning Associates, reported in CEQ's Oil and Gas---An Environmental Assessment.

2 Assumes cooperative ventures between lesses. If this does not occur, additional smaller facilities would be required.

processing plants contribute to air quality degradation. Because of the flexibility of their location, they could be placed in either rural or industrial areas, as ample suitable areas of both types exist in the four states.

In an area where no zoning regulations are in force and where no state law specific to coastal facility siting exists, it is possible that industrial or commercial land uses associated with proposed oil and gas operations could develop which would be inconsistent with existing rural land uses in the surrounding area. Where siting and zoning authorities are exercised on a local municipal basis, decisions to site facilities in one municipality could be made which may be adverse to the desires of an adjoining community. For example, a gas processing plant might be allowed to locate in one coastal community in close proximity to a second home and recreation area of another community and be considered undesirable by the second community because of aesthetic reasons, air quality degradation or other reasons. However, siting of a major facility in a coastal area in North Carolina would be subject to state approval. In Florida, controversies over land development plans are also resolved at the state level. In South Carolina and Georgia, where no coastal area facility siting regulations currently exist at the state level, siting decisions might be made which would adversely affect an adjoining jurisdiction through secondary impacts or because the facility might be inconsistent with neighboring land use. (See Section I.E.2.b.)

Pipeline corridors on land could have adverse impacts if not properly planned for and regulated. If placed across suitable areas, disturbance from burial would be temporary in nature. If placed across wetland areas, areas subject to erosion, with high water tables, poor drainage, or excess slopes, natural processes could be disrupted and/or the pipelines could be exposed. However, these conditions might also constitute engineering problems for the laying of pipeline. These engineering problems could prevent pipeline corridors in such areas, or make alternate routes more attractive economically.

A rough estimate of the width of land disturbed by pipeline would be 15 to 18 meters (50 to 60 feet) disturbed by equipment and a band of perhaps 9 to 12 m (30 to 40 feet) of soil and vegetation removal.

If placed along existing transportation rights-of-way such as highway corridors, used or abandoned railroad rights-of-way or other utility corridors, the long term impact of a pipeline corridor would be minimal—it would be consistent with the existing use of the land. If placed entirely in new corridors, a pipeline would probably traverse many land uses and a swath up to 15 m wide would need to be maintained free of trees or shrubs to permit maintenance vehicle access and to permit surveillance for leakage. Multiple use of the corridor might be made (such as a trail) but disruption and/or removal from other uses could also occur.

No estimates of onshore acreage utilized by pipelines can presently be made. Onshore pipelines for oil (0-2) may be required from landfall sites to a refinery, if one is built in the area. Onshore gas pipelines (1-2) will be required from landfalls, to processing plants, and on to existing transmission systems. Therefore, the amount of pipeline mileage will be dependent, not only on the numbers of pipelines, but landfall locations and location of processing plants relative to landfall and the existing transmission lines. No meaningful estimate can be made at this time. However, maintaining a 15 m (50 foot) swath of land vacant would require about 1.5 ha per km (6 acres per mile) of pipeline.

Secondary Land Use Impacts

In the region there is available acreage to meet cumulative land requirements of increased population and induced development. For example, Resource Planning Associates, for its report to CEQ (in Oil and Gas—An Environmental Assessment) conducted a spatial analysis of the coastal region from eastern South Carolina to northeastern Florida. This analysis included the major urban centers of Charleston, Savannah and Jacksonville, as well as the surrounding rural counties. After removing developed land and land unsuitable for development because of environmental or locational constraints, they concluded that approximately .93 million ha (2.3 million acres) of developable land exists in the roughly triangular area between Georgetown and Orangeburg Counties in South Carolina and Chatham County in Georgia. A five county region around Jacksonville, Florida, was determined to have .73 million ha (1.8 million acres) of developable land remaining. The urbanized and built-up area of the

ten coastal sectors discussed in the land use description section (II.G.8) ranged between 1.6 and 6.6% of the sector areas.

While no projection of amounts of required land has been calculated, additional commercial acreage within the region would be needed, as indicated by the growth shown in retail sales. Also required would be additional land for highway or road construction; however, it is not known whether stimulated construction would be in the form of expansion of existing highways or in new highways in new corridors.

Some manufacturing activity may be induced if the proposed sale results in oil discoveries. (Economic Impact subsection b. below.) However, very minimal increases in petrochemical activity would occur; no new facilities are anticipated to be built, but rather expansions of existing plants and higher capacity utilization could occur. Induced increases in industrial activity are anticipated to be stimulated in existing industrialized areas, so that, particularly if adequate land use controls are enforced, siting of these industries should not be a major problem.

It is possible that other rural, somewhat isolated, counties could receive similar induced industrial activity as a result of a combination of several OCS-related activities being located in them. If industries are allowed to locate in areas without existing industry, land use patterns would change. Whether those changes would be adverse would depend on how land use controls are exerted and whether changes are desired by the communities affected.

Induced infrastructure requirements, from a regional perspective, appear to be minimal, as indicated in subsection 3. below, with resulting minimal land use implications. The economic analysis indicates that construction in these sectors is not expected to be immediately stimulated by influxes of population, but rather to respond once permanent population levels become apparent.

Within a specific area, however, land use impacts could be substantial if they are not planned for and regulated. If facilities and several thousand people are drawn to one county and tend to concentrate in one or a few locales, accommodation in suitable areas could be a problem.

The Coastal Zone Management Act is designed to be an affirmative program for directing land and water use in the coastal zone. The South-Atlantic states are all scheduled to receive implementation grants in 1977 or 1978, previous to the development of most of the facilities anticipated as a result of this sale. In Chapter VIII, Section B.3. an alternative to delay the proposed sale pending implementation of coastal zone management plans is considered.

Since proposed Sale No. 43 is the first sale proposed in this area of the OCS, land use impacts that may result from this action may be greater than the impacts associated with a single sale. However, additional exploration and production activity will probably mean continued use of land beyond the time estimated for activities resulting from the initial sale, rather than duplication of land requirements for subsequent sales.

In summary, because it is believed that few pipelines and few other onshore facilities will result from this proposed sale, there should be little impact to land use patterns resulting from the sale. States and local governments control facilities and pipeline siting, and such additional construction as is necessary will have to be carefully considered and controlled. If large amounts of oil are discovered, however, which result in refining and pipeline construction becoming economically feasible, such large scale construction could have a significant impact. State siting decisions will have to be carefully made, but as is pointed out above, there is a good deal of potentially available land in already industrialized areas so that the ultimate impact on land use patterns will not be unmanageable.

The following Tables E-3A, E-3B, E-3C, and E-3D analyze the land use impacts of the proposed sale. Table E-3A displays the present (1967) land uses by catagory and county as furnished by the USDA Soil Conservation Service, along with the 1970 urban populations by county as estimated by the USDC, Bureau of Census. A ratio of uban population to urban built up land in the coastal counties of each state is then computed.

Table E-3B displays the direct land use impacts by scenarios for scenarios A, B, C, D and E and averages the direct impacts for the five scenarios. Table E-3C displays secondary land use impacts by counties for scenario B, scenario D and an average of the original five scenarios (A,B,C,D and E). In addition an average of an additional six scenarios (NC1, GMAC, FAMS, SCMAX, NCMAX and GASC) is included (for analysis and

Table E-3A PRESENT SITUATION LAND USE BY ACRES (1967)

County and State	Total	Urban - Built Up	Agricultural Use	Other	1970 Urban Population	Urban Pop./Urban - Built Up Land Areas
Baker	374,400	26,000	292,446	55,954	2,736	
Clay	382,570	11,893	369,469	1,208	16,221	
Duval	497,280	50,047	419,746	27,487	517,759	
Flagler	309,120	2,417	305,905	798	172,275	
Nassau	415,900	13,949	398,354	3,597	6,950	
Putnam	513,920	12,250	473,877	27,793	9,327	
St. Johns	389,760	11,760	375,456	2,532	12,352	
Florida (Coastal Area)	2,882,950	128,316	2,626,253	119,369	737,620	5.748 Persons/Acre
Bryan	281,000	4,600	162,200	114,200	4,818	
Camden	419,800	6,400	397,700	15,700	3,408	
Chatham	282,200	32,700	249,500	0	167,037	
Effingham	307,200	1,300	303,300	2,600	0	
Glynn	270,700	8,400	255,700	6,600	33,498	
Liberty	326,400	3,900	210,800	111,700	8,587	
Long	257,900	6,200	222,500	29,200	0	
McIntosh	275,800	13,500	250,400	11,900	0	
Georgia (Coastal Area)	2,421,000	77,000	2,052,100	291,900	217,348	2.822 Persons/Acre
Brunswick	558,720	6,690	497,118	54,912	2,220	
Columbus	601,000	5,219	577,229	18,552	7,447	
New Hanover	124,160	36,130	75,116	12,914	49,533	
Pender	548,480	3,973	508,100	36,407	1,744	
North Carolina (Coastal Area)	1,832,360	52,012	1,657,563	122,785	60,944	1.171 Persons/Acre
Beaufort	372,000	18,543	347,985	5,472	25,657	
Berkeley	704,000	29,546	475,600	198,854	25,745	
Charleston	605,000	45,416	467,203	92,381	202,654	
Colleton	671,000	26,885	644,115	0	6,257	
Dorchester	364,000	5,041	358,959	0	3,839	
Georgetown	520,000	21,801	498,199	0	13,280	
Hampton	360,000	20,716	338,972	312	2,845	
Harry	736,000	40,066	690,383	5,151	20,551	
Jasper	423,000	10,600	412,400	0	0	
Williamsburg	596,000	10,892	584,278	829	3,429	
South Carolina (Coastal Area)	5,351,000	229,506	4,818,095	302,999	304,257	1.326 Persons/Acre
South Atlantic Region U.S.A.	12,487,310	486,834	11,154,011	837,053	1,320,169	

Table E-3B DIRECT LAND USE IMPACTS IN ACRES

COUNTIES	ORIGINAL FIVE SENARIOS A	B	C	D	E	AVERAGE OF FIVE SENARIOS
Duval Co., FL		40		109.5	89.5	47.8
Bryan Co., GA			71.6			14.3
Chatham Co., GA	89.5	89.5	232.7	129.5	159.5	120.1
Glynn Co., GA			135.5	89.5		66.9
Liberty Co., GA			47.7			9.5
Charleston Co., GA		20.	20.	109.5	109.5	54.9
Total	89.5	149.5	507.5	438.0	358.5	313.5

COUNTIES	ADDITIONAL SIX SENARIOS NC	GASC	FMAX	GMAX	SCMAX	NCMAX	AVERAGE OF SIX SENARIOS
Duval Co., FL	149.5		259.3				68.1
Bryan Co., GA		59.7					10
Camden Co., GA		89.5		109.5			33.2
Chatham Co., GA		107.4					17.9
Glynn Co., GA		227		358.6			97.6
Liberty Co., GA		83.5					13.9
McIntosh Co., GA		107.4					17.9
New Hanover Co., NC	89.5					295.3	64.1
Charleston Co., SC		364.2			209.5		95.6
Georgetown Co., SC		89.5			20.0		18.3
Jasper Co., SC		276.7					46.1
Total	239.0	1404.9	259.3	468.1	229.5	295.3	449.5

Table E-3C

1996
INDIRECT LAND USE IMPACT ESTIMATES IN ACRES
FROM POPULATION INCREASES

County and State	Impact of Senario B	Impact of Senario D	Average of Original Five Senario Impacts	Average of Additional Six Senario Impacts
Baker	.5	2.4	.9	-1.4
Clay	1	4.4	.2	-11.8
Duval	81.6	746.2	214.7	363.8
Flagler	0	.5	.2	3.1
Nassau	1.4	3	1.7	6.4
Putnam	-3	4.5	.5	15.7
St. Johns	0	2.3	.5	5.2
Florida (Coastal Area)	81.5	763.3	218.7	378.7
Bryan	-2.8	4.9	3.2	15.6
Camden	0	.4	0	840.5
Chatham	282.4	78.6	933.2	155.6
Effingham	1.8	11.3	3.9	-1.1
Glynn	-.7	900.6	260.3	404
Liberty	1.4	7.1	-2.5	-7.1
Long	1.1	5.7	2.5	8.5
McIntosh	3.2	4.9	-1.8	7.4
Georgia (Coastal Area)	286.4	1013.5	1198.8	1423.4
Brunswick	1.7	11.1	4.2	26.5
Columbus	0	11.1	1.7	46.1
New Hanover	5.1	35.8	12.8	899.2
Pender	-.9	11.9	1.7	3.4
North Carolina (Coastal Area)	5.9	69.9	20.4	975.2
Beaufort	5.3	21.9	9.1	-70.9
[illegible]ley	-8.3	17.3	-4.5	36.2
[illegible]leston	705.9	4197	1267.7	1498.5
Colleton	-.8	5.3	0	19.6
Dorchester	.8	22.6	4.5	0
Georgetown	-2.3	15.1	.8	979.6
Hampton	-.8	.8	-.8	8.3
Harry	-.8	19.6	9.8	-61.1
Jasper	3	6.8	5.3	7.5
Williamsburg	25.6	20.4	11.3	2.3
South Carolina (Coastal Area)	728	4327	1303	2420
South Atlantic Region U.S.A.	1455	6174	2741	5197

Table E-3D

SUMMARY OF DIRECT AND INDIRECT IMPACTS ON LAND USE
LAND USE IMPACT ESTIMATES IN ACRES

	Original Five Senarios Average			Additional Six Senarios Average		
	Direct Land Use	Indirect Land Use	Direct and Indirect Land Use	Direct Land Use	Indirect Land Use	Direct and Indirect Land Use
Baker		.9	.9		-1.4	-1.4
Clay		.2	.2		-11.8	11.8
Duval	47.8	214.7	262.5	68.1	363.8	431.9
Flagler		.2	.2		3.1	3.1
Nassau		1.7	1.7		6.4	6.4
Putnam		.5	.5		15.7	15.7
St. Johns		.5	.5		5.2	5.2
Florida (Coastal Area)	47.8	218.7	266.5	68.1	378.7	446.8
Bryan	14.3	3.2	17.5	10	15.6	25.6
Camden		0	0	33.2	840.5	873.7
Chatham	120.1	933.2	1053.3	17.9	155.6	173.5
Effingham		3.9	3.9		-1.1	-1.1
Glynn	66.9	260.3	327.2	97.6	404	501.6
Liberty	9.5	-2.5	7	13.9	-7.1	6.8
Long		2.5	2.5		8.5	8.5
McIntosh		-1.8	-1.8	17.9	7.4	25.3
Georgia (Coastal Area)	210.8	1198.8	1409.6	190.5	1423.4	1613.9
Brunswick		4.2	4.2		26.5	26.5
Columbus		1.7	1.7		46.1	46.1
New Hanover		12.8	12.8	64.1	899.2	988.6
Pender		1.7	1.7		3.4	3.4
North Carolina (Coastal Area)		20.4	20.4	64.1	975.2	1039.3
Beaufort		9.1	9.1		-70.9	-70.9
Berkeley		-4.5	-4.5		36.2	36.2
Charleston	54.9	1267.7	1322.6	95.6	1498.5	1594.1
Colleton		0	0		19.6	19.6
Dorchester		4.5	4.5		0	0
Georgetown		.8	.8	18.3	979.6	997.9
Hampton		-.8	-.8		8.3	8.3
Harry		9.8	9.0		-61.1	-61.1
Jasper		5.3	5.3	46.1	7.5	53.6
Williamsburg		11.3	11.3		2.3	2.3
South Carolina (Coastal Area)	54.9	1303.	1357.9	160.	2420.	2580.
South Atlantic Region U.S.A.	313.5	2741.	3055.	499.5	5197.	5697.

discussion of the additional six scenarios read Chapter IV, for Appendix K). These impacts are computed by multiplying estimated population impacts (see Section III.E.4. Impact on Population and Chapter IV, Part D of appendix K) by the inverse ratio of urban population to urban built up land for each state. Table E-3D summarizes the three previous tables and displays the addition of an average of direct and indirect impacts on land use for the first five scenarios and for the six additional scenarios.

3. Economic Impacts

A. IMPACT ON EMPLOYMENT

In order to provide some estimates of the employment and other economic effects that may result from this sale several scenarios incorporating hypothetical locations that might be impacted by OCS related activities were prepared. Dr. Curtis Harris, of the University of Maryland, utilized this input data in the Harris economic model. The output from this model included estimates of the influence of sale related activities upon the population, civilian labor force, earnings, investment, and several other parameters of economic significance. It should be emphasized that the estimates provided below are not predictions that OCS related activity will occur within the political subdivisions identified in the following data presentations or that the degree of economic impact predicted in the various scenarios will be reached, or that the events will occur in accordance with the hypothesized time frames.

The scenarios were chosen to illustrate a range of possible impacts that may result from Sale 43, and although the scenarios are believed to incorporate reasonable assumptions, other scenarios incorporating equally reasonable assumptions could be developed.

The results determined by the various scenarios should be employed with caution, since they are based on rigid assumptions which may not completely reflect the economic changes that the actual operations will produce. Generally speaking, when a choice of data could be made, a selection was made that would tend to produce estimated impacts within the four southeastern states that are probably higher than those which may result from actual operations. Some of these assumptions include:

(1) All employment and the subsequent population estimates, are identified with specified counties within the various scenarios. Other information indicates that offshore workers could reside within a 250 mile radius of the operations point, an area considerably larger than a single county, and the density of population could be less than anticipated.

(2) All investment in facilities has been assigned to specified counties. In the event that expenditures are made in other areas, where specialized facilities for the manufacture of some types of equipment are in existence, the investment, and resulting employment will be less than anticipated.

(3) Allocations of Federal funds have been included as input data into the models. Although the recent Coastal Zone Act amendments establish a link between OCS activity and additional Federal funding, a more precise value would probably differ from the sum included for these estimates.

In considering the coastal region as a whole, the mathematical ratio between the number of persons directly employed as a result of sale related activities (input data) and the total increase in the number of employed civilian persons ranged from 1.79 to 4.38. In Scenario B, the ratio ranged from a value of 2.02 in the year 1980, to 4.38 in 1996. In Scenario C, the mathematical ratio ranged from 2.00 in 1980 to 3.61 in 1996. In Scenario E, the ratio ranged from 1.79 in 1980 to 3.35 in 1996.

In the South Atlantic Region, which consists of the coastal portions of the four state area, the estimated changes in total civilian employment that are attributed to the sale range from 955 to 7,817, depending on the scenario chosen and the year from which the data are selected.

A summary of the scenarios and the change in civilian employment will be found in Table E-5 and Table E-6.

Tables E-7, E-8 and E-9 include estimates of the changes in the numbers of civilian persons employed as a result of the hypothesized scenarios described previously. The data are provided as estimated employment effects on a county basis. These data represent the lowest employment impact noted in a specific county from any of the postulated scenarios, as well as the highest employment impact from any of the scenarios. The average shown is the average of the employment impacts in a specific county resulting from the five specified scenarios. The sum of the minimum or maximum county employment impacts will not necessarily agree with the estimates

Table E-5 Summary of Sale Induced Civilian Employment
(South Atlantic Region)

	Scenario					
YEAR	A	B	C	D	E	Average
1980	955	955	947	2661	2646	1633
1984	2682	1856	1843	3824	3883	2818
1988	1241	1329	1202	7818	5903	3499
1992	1038	1770	1515	3933	3593	2370
1996	1080	1999	1633	4285	3709	2541

Note: Scenarios A, B, and C are based on the low resource estimates, Scenarios D and E are based on the high resource estimates. Rounded to the nearest unit.

Table E-6 Summary of Sale Induced Civilian Employment
By States - Selected Years

	Scenario				
State & Year	A	B	C	D	E
N. Carolina					
1980	12	12	12	20	20
1988	14	14	15	57	48
1996	12	21	23	36	50
S. Carolina					
1980	62	62	62	812	813
1988	57	-64*	-62*	4203	2263
1996	52	448	454	1448	1388
Georgia					
1980	850	850	843	894	894
1988	1149	1155	1220	1539	2111
1996	995	1064	1113	1001	1350
Florida					
1980	31	31	31	935	919
1988	22	224	30	2019	1482
1996	21	465	44	1799	921

* Accompanied by decrease in unemployment, indicating migration of labor force.

Table E-7

Summary of Civilian Employment
Range and Average from Five Scenarios

State and County	Year 1980		
	Low	High	Average (rounded)
North Carolina			
Brunswick	1	1	1
Columbus	2	4	3
New Hanover	7	12	9
Pender	2	3	2
South Carolina			
Beaufort	4	4	4
Berkeley	2	4	3
Charleston	40	777	335
Colleton	1	2	1
Dorchester	3	5	4
Georgetown	3	6	4
Hampton	0	0	0
Horry	6	10	8
Jasper	1	1	1
Williamsburg	2	3	2
Georgia			
Bryan	0	1	0
Camden	0	0	0
Chatham	109	838	545
Effingham	2	4	3
Glynn	6	775	314
Liberty	3	4	3
Long	0	1	0
McIntosh	0	0	0
Florida			
Baker	1	2	1
Clay	3	5	4
Duval	21	918	377
Flagler	0	0	0
Nassau	1	1	1
Putnam	3	5	4
St. Johns	1	3	2

Table E-8

Summary of Civilian Employment
Range and Average from Five Scenarios

Year 1988

State and County	Low	High	Average (rounded)
North Carolina			
Brunswick	1	3	2
Columbus	2	10	5
New Hanover	8	35	18
Pender	2	8	4
South Carolina			
Beaufort	3	8	5
Berkeley	3	13	6
Charleston	-89	4104	1228
Colleton	1	5	2
Dorchester	3	13	7
Georgetown	3	19	9
Hampton	0	0	0
Horry	7	29	15
Jasper	1	4	2
Williamsburg	2	9	4
Georgia			
Bryan	1	11	4
Camden	-1	0	0
Chatham	180	1193	825
Effingham	3	11	6
Glynn	5	1614	593
Liberty	1	9	4
Long	1	2	1
McIntosh	1	6	2
Florida			
Baker	2	7	4
Clay	3	14	7
Duval	10	1971	730
Flagler	0	1	0
Nassau	1	3	2
Putnam	4	15	8
St. Johns	2	7	4

Table E-9

Summary of Civilian Employment
Range and Average from Five Scenarios

Year 1996

State and County	Low	High	Average (rounded)
North Carolina			
Brunswick	1	5	3
Columbus	2	8	4
New Hanover	8	32	18
Pender	2	5	3
South Carolina			
Beaufort	2	8	5
Berkeley	2	7	5
Charleston	30	1389	712
Colleton	1	4	2
Dorchester	3	12	7
Georgetown	4	10	6
Hampton	0	1	0
Horry	6	21	13
Jasper	1	8	4
Williamsburg	2	5	3
Georgia			
Bryan	0	10	4
Camden	0	1	0
Chatham	139	1088	737
Effingham	2	8	5
Glynn	5	886	350
Liberty	2	6	4
Long	1	4	3
McIntosh	0	4	2
Florida			
Baker	2	4	3
Clay	3	7	5
Duval	10	1765	624
Flagler	0	1	1
Nassau	1	12	6
Putnam	4	14	8
St. Johns	2	7	4

Table E-10 Output Categories
Harris Multiregional Multiindustrial Model

Civilian Labor Force
Net Commuters
Civilian Unemployment
Civilian Unemployment Rate
Population Density
Multijob Holders
Net Population Migration
Population Associated with Labor Force Surplus
Population
Personal Income
Earnings
Property Income
Social Insurance Payments
Transfer Payments
Agricultural Value of Land Per Acre
Federal Government Expenditures (exclude construction)
State and Local Government Expenditures
Federal Government Purchases (exclude construction)
State and Local Government Purchases
Personal Consumption Expenditures
Private Investment
Per Capita Income
Total Supply
Total Demand
Domestic Output
Competing Imports
Non-competitive Industry Imports
Non-competitive Consumer Imports
Gross Foreign Exports
Value Added
Equipment
Construction
Federal Defense Expenditures
Gross Regional Product

relating to the state coastal region totals, since for any given scenario, minimal estimates in one county may be accompanied by moderate increases in an adjacent county; and in another scenario, the situation may be reversed.

These estimates may provide some concept of the range of employment changes that may result on a county level. However, no estimates of the probability of a given scenario being correct could be determined except that the resource estimates provided by the Geological Survey indicate that the low resource estimates used in Scenarios A, B, and C have a higher probability than the high resource estimates incorporated in Scenarios D and E. One possible use of these tables would be to form a tentative concept of the employment impacts in specified areas, given that part of the total impacts may occur in other parts of the coastal region.

The changes in Civilian Employment for these 5 scenarios, as presented on the tables, provide the range in civilian employment impacts on a county level. For example, in the year 1988, the Civilian Employment impact in Charleston County, South Carolina could range from −89 to 4,104 depending on the scenario chosen. The average civilian employment impact from the five runs amounts to 1,228 persons. If each of the scenarios was assigned an equal probability of occurrence, then the average would serve as the expected value. However, this degree of quantification has not been made, nor are the number of scenarios selected sufficient to exhaust all possible points of onshore impact, therefore at the present time, the ranges of effects are the preferred guide to the extent of economic impacts that may result from the sale.

Although the projections of base line conditions are a basic calculation of the Harris Model, selected comparisons have been made to other projections.

The estimated total employment for three specified Standard Metropolitan Statistical Areas have been obtained from Volume 5, 1972 OBERS Projections, based on the Series E population projections.

The minimum and maximum employment impacts anticipated for these areas have been compared to this total estimated employment.

In the event that increases in employment should result in communities smaller than the metropolitan areas identified in Table E-11 employment impact would be greater than indicated.

For example, in Glynn County, Ga., the estimated high change in civilian employment in the year 1988 amounts to 1,614 persons. The 1973 issue of County Business Patterns indicates a total at 16,410 employees within the county during March of that year. In this case, the civilian employment impact would be equal to approximately 10 per cent of the 1973 employment. In the event that employment should increase in Glynn County during the 15 year period 1973-1988, the civilian employment in Glynn County should increase, thus anticipated impact would be a smaller percentage of the total civilian employment.

The impact of this proposed sale in the coastal portions of the South Atlantic states on civilian employment is a small, but positive, increase in employment. The maximum increase in sale induced civilian employment occurred in the year 1988 (Scenario D), with a projected increase of 4,203 in South Carolina, and a total of 7,818 in the entire four state region.

Additional subsequent sales in this area could have a similar impact on employment, but it is more likely that smaller increases in incremental employment would result from these additional sales, due to the use of terminals, pipelines, and operations bases for longer periods of time. No employment effects from the Mid Atlantic and North Atlantic OCS leasing activity are anticipated in the South Atlantic states.

B. IMPACT ON INCOME

For the purpose of providing an estimate of the economic impacts that may result from OCS Sale 43, additional summary sheets have been prepared on the selected variables: earnings (Tables E-12 and E-13), change in per capita income (Tables E-14 and E-15), residential construction (Tables E-16 and E-17), and private investment (Tables E-18 and E-19). These data are presented for Scenarios B and E as examples of the type and degree of impact that may be expected.

The effect of the sale related activities on earnings, as developed by Scenario E (Table E-13), indicates a maximum increase of earnings amounting to more than 88 million dollars in the year 1988 for the entire South Atlantic region. The major increases in earnings were recorded in Duval County, Florida, Glynn County, Georgia, and Charleston County, South Carolina. For Scenario E Charleston County, South Carolina was assumed as the location for operations base

Table E-11 Comparison of Future Estimated Employment Impact

SMSA [1]	1990 Total Employment	Minimum Impact	Maximum Impact	Maximum Impact Per Cent
Jacksonville, FL	323,600	10[2]	1971[2]	0.6%
Savannah, GA	84,600	180[3]	1193[3]	1.4%
Charleston, SC	135,500	-89[4]	4104[4]	3.03%

1/ Standard Metropolitan Statistical Area

2/ Duval Co., FL

3/ Chathan Co., GA

4/ Charleston, Co., SC

Table E-12 SCENARIO B-I SUMMARY OF ECONOMIC IMPACTS

Earnings - Impact Estimates

State & County	1980	1984	1988	1992	1996
N. Carolina					
Brunswick	9	11	9	14	19
Columbus	19	31	21	29	32
New Hanover	55	90	70	102	143
Pender	19	32	21	26	29
S. Carolina					
Beaufort	117	211	136	172	188
Berkeley	18	31	20	24	26
Charleston	491	742	-103	5313	6901
Colleton	7	11	8	13	16
Dorchester	21	34	24	31	38
Georgetown	21	38	26	32	35
Hampton	2	3	3	4	5
Horry	70	118	83	103	116
Jasper	4	7	9	18	34
Williamsburg	12	20	8	21	22
Georgia					
Bryan	4	8	10	24	24
Camden	0	-1	0	1	3
Chatham	11,945	25,327	18,296	17,561	19,316
Effingham	18	34	26	31	51
Glynn	62	101	66	77	83
Liberty	32	49	30	38	41
Long	3	6	6	12	22
McIntosh	4	8	10	15	25
Florida					
Baker	11	17	13	19	21
Clay	30	49	33	37	40
Duval	299	914	3410	5838	7685
Flagler	3	5	4	5	6
Nassau	11	14	12	24	36
Putnam	34	59	44	61	77
St. Johns	19	29	22	29	35

All figures are in thousands of 1972 dollars.

Table E-13 SCENARIO B-I SUMMARY OF ECONOMIC IMPACTS

Change in Per Capita Income Impact Estimates

State & County	1980	1984	1988	1922	1996
N. Carolina					
Brunswick	0	1	0	0	1
Columbus	0	1	1	1	1
New Hanover	1	1	1	1	1
Pender	1	2	1	1	2
S. Carolina					
Beaufort	1	3	2	2	2
Berkeley	0	1	0	1	1
Charleston	1	2	3	7	10
Colleton	0	0	0	0	1
Dorchester	1	1	1	1	1
Georgetown	1	1	1	1	1
Hampton	0	0	0	1	1
Horry	1	1	1	1	1
Jasper	0	1	1	1	2
Williamsburg	0	0	0	0	-3
Georgia					
Bryan	1	1	1	1	7
Camden	0	0	0	0	0
Chatham	22	64	26	19	21
Effingham	1	2	2	2	3
Glynn	1	2	1	1	1
Liberty	1	2	1	1	1
Long	1	1	0	0	1
McIntosh	1	1	0	0	1
Florida					
Baker	1	1	1	1	1
Clay	1	1	1	1	1
Duval	0	1	9	12	13
Flagler	1	1	1	1	1
Nassau	0	0	0	0	0
Putnam	1	1	1	1	1
St. Johns	1	1	1	1	1

All figures are in thousands of 1972 dollars.

Table E-14

SCENARIO B-I SUMMARY OF ECONOMIC IMPACTS
Residential Construction Impact Estimates
(Thousands of 1972 dollars)

State & County	1980	1984	1986	1988	1992	1996
N. Carolina						
Brunswick	0	0		1	1	0
Columbus	0	0		0	1	1
New Hanover	1	1		2	2	3
Pender	1	1		1	0	1
S. Carolina						
Beaufort	5	5	7	5	4	4
Berkeley	0	0		0	0	0
Charleston	18	16	368	150	160	198
Colleton	0	0		0	0	1
Dorchester	1	1		1	1	1
Georgetown	0	0		1	1	0
Hampton	0	-1		0	0	0
Horry	2	3		3	2	3
Jasper	1	0		0	1	1
Williamsburg	1	0		-1	1	0
Georgia						
Bryan	0	0		1	0	1
Camden	0	0		0	0	0
Chatham	617	694	885	748	579	589
Effingham	0	0		1	1	2
Glynn	2	2		2	2	2
Liberty	1	1		1	1	2
Long	0	0		0	0	0
McIntosh	0	0		0	1	1
Florida						
Baker	1	0		0	1	1
Clay	1	1		1	1	0
Duval	6	13	736	60	145	192
Flagler	0	0		1	1	0
Nassau	0	0		0	1	1
Putnam	1	0		2	2	1
St. Johns	1	0		1	1	1
Region	659	741	2014	981	902	1002

Table E-15 SCENARIO B-I SUMMARY OF ECONOMIC IMPACTS
Private Investment Impact Estimates

State & County	1980	1984	1988	1992	1996
N. Carolina					
Brunswick	0	0	1	2	3
Columbus	0	0	1	3	2
New Hanover	1	0	2	4	9
Pender	1	0	1	1	1
S. Carolina					
Beaufort	5	6	6	6	7
Berkeley	0	0	0	0	1
Charleston	27	28	394	1042	1444
Colleton	0	0	0	1	2
Dorchester	1	0	1	1	2
Georgetown	0	0	1	1	1
Hampton	0	0	0	0	0
Horry	3	3	5	6	9
Jasper	0	0	0	1	2
Williamsburg	0	1	-1	1	2
	36	37	407	1061	1470
Georgia					
Bryan	0	0	0	1	1
Camden	0	0	0	0	0
Chatham	15,975	69,944	8,817	4,075	4,243
Effingham	1	1	1	1	2
Glynn	3	2	3	3	3
Liberty	2	1	1	1	2
Long	0	0	0	1	1
McIntosh	0	1	2	3	4
Florida					
Baker	0	0	1	1	2
Clay	1	1	1	1	1
Duval	8	223	1313	2670	4117
Flagler	0	0	0	0	0
Nassau	0	0	0	1	2
Putnam	1	0	2	3	5
St. Johns	1	0	1	2	3
Region	16,030	70,213	10,556	7,833	9,871

All figures are in thousands of 1972 dollars.

Table E-16 SCENARIO E-II SUMMARY OF ECONOMIC IMPACTS
Earnings Impact Estimates

State & County	1980	1984	1988	1992	1996
N. Carolina					
Brunswick	13	17	25	34	47
Columbus	31	46	74	60	89
New Hanover	88	133	227	243	366
Pender	33	50	78	59	66
S. Carolina					
Beaufort	201	320	502	342	347
Berkeley	31	47	72	49	53
Charleston	9979	17248	33,288	15,411	21,952
Colleton	9	14	24	31	40
Dorchester	36	53	87	70	88
Georgetown	36	57	92	66	69
Hampton	3	5	7	8	12
Horry	116	117	283	220	256
Jasper	7	11	22	45	96
Williamsburg	18	29	46	40	38
Georgia					
Bryan	7	13	28	64	157
Camden	-2	-3	-2	4	8
Chatham	1514	2274	6917	7,397	7157
Effingham	32	54	89	68	86
Glynn	10,566	17,415	23,684	19,398	17,412
Liberty	50	73	107	86	78
Long	6	9	18	34	64
McIntosh	7	13	25	32	57
Florida					
Baker	18	27	40	36	39
Clay	50	74	116	76	75
Duval	12,213	16,262	22,203	14,602	14,995
Flagler	5	8	13	11	15
Nassau	11	17	32	67	104
Putnam	56	88	143	133	173
St. Johns	31	45	74	67	82
	12,385	16,521	22,622	14,992	15,483
Region	35,165	55.076	88,315	58,752	64,023

All figures shown are in thousands of dollars.

Table E-17 SCENARIO E-II SUMMARY OF ECONOMIC IMPACTS
Change in Per Capita Income Impact Estimates

State & County	1980	1984	1988	1992	1996
N. Carolina					
Brunswick	1	1	1	1	1
Columbus	1	1	2	1	2
New Hanover	1	1	2	2	3
Pender	2	3	5	3	3
S. Carolina					
Beaufort	3	4	7	4	4
Berkeley	1	1	2	1	1
Charleston	16	24	53	27	38
Colleton	1	1	1	1	1
Dorchester	1	2	2	2	2
Georgetown	1	2	3	2	2
Hampton	0	1	1	1	1
Horry	1	2	3	2	2
Jasper	1	1	2	4	6
Williamsburg	1	4	4	4	3
Georgia					
Bryan	1	2	3	2	12
Camden	0	0	1	1	1
Chatham	6	11	-58	-53	-66
Effingham	2	4	6	4	6
Glynn	76	117	212	221	212
Liberty	2	3	4	3	3
Long	1	2	3	4	6
McIntosh	1	2	3	3	6
Florida					
Baker	1	2	3	2	2
Clay	1	2	3	2	2
Duval	7	9	15	5	5
Flagler	1	2	3	2	2
Nassau	0	1	1	2	2
Putnam	1	2	3	2	3
St. Johns	1	1	2	2	2

Table E-18

SCENARIO E-II SUMMARY OF ECONOMIC IMPACTS
Residential Construction Impact Estimates
(Thousands of 1972 Dollars)

State & County	1980	1984	1986	1988	1990	1992	1996
N. Carolina							
Brunswick	0	0		0		1	1
Columbus	1	0		1		1	2
New Hanover	1	2		4		4	8
Pender	1	1		1		2	1
S. Carolina							
Beaufort	7	8	24	12		9	8
Berkeley	1	0		0		0	0
Charleston	0	549	666	343	1422	438	620
Colleton	0	0		0		1	1
Dorchester	1	1		2		2	2
Georgetown	1	1		1		1	2
Hampton	0	0		0		0	0
Horry	3	4		6		6	6
Jasper	0	0		1		1	2
Williamsburg	0	1		1		0	1
Georgia							
Bryan	0	1		0		1	3
Camden	0	0		0		0	0
Chatham	48	77	2230	297		297	260
Effingham	1	1		2		2	2
Glynn	413	565	2286	795		656	485
Liberty	2	2		2		2	2
Long	1	0		1		1	2
McIntosh	0	0		1		1	2
Florida							
Baker	0	1		1		0	1
Clay	1	2		2		1	2
Duval	407	438	582	647		458	460
Flagler	0	0		0		0	1
Nassau	0	0		1		2	2
Putnam	1	1		2		3	4
St. Johns	0	1		1		1	2
Region	1,288	1,652	5,825	2,385		1,873	1,878

Table E-19 SCENARIO E-II SUMMARY OF ECONOMIC IMPACTS
Private Investment Impact Estimates

State & County	1980	1984	1988	1992	1996
N. Carolina					
Brunswick	1	2	3	4	5
Columbus	3	5	8	6	8
New Hanover	12	18	30	25	32
Pender	3	4	7	5	5
S. Carolina					
Beaufort	4	6	8	8	8
Berkeley	4	7	10	7	7
Charleston	777	1,284	2,178	970	1,313
Colleton	2	2	4	4	4
Dorchester	5	7	11	9	12
Georgetown	6	9	15	10	10
Hampton	0	0	0	0	1
Horry	10	16	25	18	21
Jasper	1	2	3	4	8
Williamsburg	3	5	7	5	5
Georgia					
Bryan	1	1	3	6	10
Camden	0	0	0	0	1
Chatham	110	193	474	464	430
Effingham	4	6	9	6	430
Glynn	775	1,187	1,614	1,095	886
Liberty	4	6	8	7	6
Long	1	1	2	3	4
McIntosh	0	1	1	2	4
Florida					
Baker	2	4	5	4	4
Clay	5	8	12	7	7
Duval	902	1,096	1,441	900	876
Flagler	0	1	1	1	1
Nassau	1	2	3	7	12
Putnam	5	8	13	11	14
St. Johns	3	4	7	6	7
Region	2,646	3,883	5,903	3,593	3,709

and a gas terminal and gas processing plant; Glynn County, Georgia was assumed as the location of a gas terminal and an operations base; and Duval County, Florida, as an operations base. The base case for this calculation incorporated an operating petroleum refinery in Chatham County, Georgia. Of the total of 88 million dollars increase in earnings in 1988, approximately 90% was attributed to the three counties. The change in civilian persons employed indicates than 89% of the increase in employment can be expected in these three counties. On the basis of a comparison between the earnings and civilian persons employed, the impact on both of these factors appears to be most pronounced at the areas selected for the onshore sites for OCS related activites, and the effects in adjacent counties appears to be minimal. In large part, the distribution of employment effects is controlled by the specification of the input data. Alternative residential locations could have been specified for the work force associated with sale related activities, and presumably, this substitution would have produced different impact patterns.

The relationships discussed above suggest that, prior to additional information to be gained from additional events; such as the actual sale, the exploratory drilling, the production operations (should the exploratory drilling produce encouraging results), the onshore income effects to be anticipated from a sale are highly speculative.

Considering Scenarios B (Table E-14) and E (Table E-15), changes in per capita income as a result of the proposed sale were either neutral or positive in all cases with the exception of a negative effect in Williamsburg County, South Carolina, in the year 1996 (Table E-13), and in Chatham County, Georgia in the years 1988, 1992, and 1996. However, the per capita income effects in the states, and for the region, were positive for both scenarios over the years covering the operations.

In summary, the impact of the sale on incomes in the South Atlantic coastal area is forecast to be a moderate increase in per capita income in the region, concentrated in those areas in which onshore facilities are established.

Additional sales in the area, resulting in additional employment, would be expected to also have an incremental positive impact on per capita income. The income effects are foreseen to be mostly limited to local areas.

The impact of additional sales in the Mid Atlantic and South Atlantic areas are not foreseen to have a significant impact on per capita incomes beyond the vicinity of the support and terminal facilities resulting from the proposed sales.

c. Impact on residential construction

Output estimates are available for several construction sectors. The summary table has been prepared for the category residential construction for Scenarios B and E.

In Scenario B (Table E-16), residential construction due to sale related activities is anticipated to increase from $659 (thousand 1972 dollars) in the year 1980 to $2,014 (thous. 1972) in 1986 and to decline to approximately $1,000 (thous. 1972) in the year 1996. These construction impacts are concentrated in Duval County, Florida, Chatham County, Georgia and Charleston County, South Carolina.

In Scenario E (Table E-17) based on the high resource estimates, the sale related increase in residential construction ranges from $1,288 (thous. 1972) in the year 1980 to $5,825 (thous. 1986) in the year 1986, and declines to approximately $1,900 (thous. 1972) in the year 1996.

This estimated increase in sale-related residential construction supports the hypothesis that additional land for the construction of residential facilities will be required.

The residential construction requirements for this proposed sale and subsequent possible lease offerings that may occur on the OCS adjacent to the South Atlantic states are forecast to occur in the vicinity of the locations of the support facilities and terminals. The incremental additions resulting from future sales would be less than those attributed to this sale, due to the probable use of facilities established for the initial sale to service activities resulting from subsequent OCS leasing.

The cumulative impact of this proposed sale and the OCS leases issued in the Mid Atlantic region on residential construction in the South Atlantic states would be limited to the areas in the vicinity of support facilities and terminals. No induced residential construction in the South Atlantic area is anticipated to result from operations germane to the Mid Atlantic area, nor would residential construction be induced in the Mid Atlantic states as a result of Sale 43.

d. Impact on private investment

The impact on private investment (Tables E-18 and E-19) was also either neutral or positive for all counties during the estimated time span of the project, with the exception of a slight decline in Williamsburg County, South Carolina in 1988 (Scenario B, Table E-18). The private investment effects due to proposed sale related activities were positive for each state, as well as for the region as a whole.

The cumulative impacts that are expected to result from this proposed lease offering, as well as future proposed lease offerings in the South Atlantic region, may be greater than those estimated to result from a single sale, but not to increase in direct proportion to the amount of acreage offered in these various sales, but to increase at a rate less than the acreage offerings.

Private investment related to OCS acreage offerings in the Mid Atlantic region would take place primarily in regions adjacent to the sale area, and would have little, or no effect on private investment in the South Atlantic region.

e. Summary of economic impacts

To summarize, the major direct economic impacts of the sale are estimated to consist of increases in civilian employment generally occurring within the coastal portions of the four state area, increases in earnings, generally positive effects on per capita income, increases in residential construction expenditures, and increased private investment. For certain counties, however, exceptions to these general conclusions have been noted in the output provided by the Harris Model calculations.

The impact of the various factors considered within the frame of economic impacts were experienced primarily within the coastal areas of the South Atlantic states, and were concentrated within the counties assumed to be the sites of support facilities and terminals.

Since proposed Sale 43 is the initial offering of OCS leases in the South Atlantic region, future cumulative impacts may be greater than those estimated for a single sale. However, the largest economic impacts would result from the installation and operation of facilities required for the initial sale, and these facilities would probably be employed to service additional acreage and production resulting from future sales.

Therefore, it is probable that the effect of additional sales would be to extend the use of these facilities beyond the time required for servicing the output from the original lease offering.

OCS leases have recently been awarded in the Mid Atlantic region, and consideration is being given to lease offerings in the North Atlantic region of the OCS.

It is not likely that operations in these areas will have an economic impact in the coastal areas of the southeastern U.S., nor that operations in the South Atlantic OCS will have an economic impact in the northern portions of the Atlantic Coastal states.

4. Impact on Population

The changes in population in the coastal regions of the states of North Carolina, South Carolina, Georgia, and Florida that may be attributed to activities resulting from proposed OCS Sale No. 43 have been estimated by Dr. C. Harris of the University of Maryland, based on input data provided by the New Orleans OCS Office of BLM.

The changes in population in the entire four state area range from 2,022 to 22,111, depending on the year chosen and the assumptions incorporated into the hypothetical development schemes, or scenarios (refer to Table E-20).

For the entire Atlantic coast region of the states of North Carolina, South Carolina, Georgia and Florida, the population changes estimated to result from Sale 43 vary depending on the scenario selected (refer to Table E-21).

Scenarios A, B, and C are based on the low resource estimate provided by the U.S. Geological Survey, and Scenarios D and E are based on the high estimates. The variation in population is large, when all of the scenarios are considered, but the range in estimated impacts narrows when the scenarios are considered as two groups. In runs A, B, and C the population impacts vary from 2,022 to 4,464 and in scenarios D and E the estimates range from 6,613 to 22,111.

Generally speaking, each scenario indicates an increase in population followed by a subsequent decrease. This effect is more pronounced in Scenarios D and E than in the scenarios incorporating the low resource estimates.

Population impacts on a county level have been calculated by Dr. Harris. A summary of these population changes for scenarios B and D have been included in the following Tables, E-22 and E-23.

Table E-20

Increased Population (Sale 43)
Scenario

State & Year	A	B	C	D	E
N. Carolina					
1984	-10	-7	-7	57	-16
1988	-3	-2	-1	115	-20
1996	-2	8	9	82	22
S. Carolina					
1984	24	33	-15	3888	3481
1988	4	-346	-386	12462	5441
1996	30	976	922	4370	2334
Georgia					
1984	5321	3438	3186	3883	3709
1988	4484	3033	2913	4459	7327
1996	4187	2783	2358	2861	4731
Florida					
1984	-14	75	-4	2824	2628
1988	-20	-664	-14	5075	2822
1996	-24	-467	-15	4385	2392

Table E-21

Population Impacts (Sale 43)
South Atlantic Region
Scenario

Year	A	B	C	D	E
1980	2272	2272	2222	7,301	6,613
1984	5321	3540	3159	10,652	9,802
1988	4464	2022	2512	22,111	15,570
1992	4010	3154	3380	10,680	9,636
1996	4192	3300	3274	11,698	9,478

Table E-22 SCENARIO B-I SUMMARY OF POPULATION IMPACTS
Impact Estimates

State & County	1980	1984	1988	1992	1996
N. Carolina					
Brunswick	0	-1	0	1	2
Columbus	-2	-5	-3	0	0
New Hanover	0	0	2	2	6
Pender	0	-1	-1	-1	-1
S. Carolina					
Beaufort	11	8	7	7	7
Berkeley	-5	-9	-8	-10	-11
Charleston	45	33	-351	872	936
Colleton	-2	-3	-2	-2	-1
Dorchester	-1	-3	-2	-1	1
Georgetown	-2	-3	-2	-3	-3
Hampton	0	-1	-2	-2	-1
Horry	0	-1	-2	-2	-1
Jasper	0	0	0	1	4
Williamsburg	-1	10	7	11	34
Georgia					
Bryan	0	0	2	8	-8
Camden	-1	-1	-1	0	0
Chatham	2209	3435	3019	2811	2773
Effingham	1	1	3	3	5
Glynn	1	-1	-1	-2	-2
Liberty	5	4	3	4	4
Long	0	0	0	1	3
McIntosh	0	0	6	7	9
Florida					
Baker	1	1	1	2	3
Clay	0	-2	-3	-5	-6
Duval	13	79	-662	-561	-469
Flagler	0	-1	0	0	0
Nassau	1	2	4	5	8
Putnam	-2	-3	-3	-2	-2
St. Johns	0	-1	0	0	0

Table E-23 SCENARIO D-I SUMMARY OF POPULATION IMPACTS
Impact Estimates

State & County	1980	1984	1988	1992	1996
N. Carolina					
Brunswick	4	6	10	9	13
Columbus	6	9	20	9	13
New Hanover	21	30	60	30	42
Pender	8	12	24	13	14
S. Carolina					
Beaufort	16	20	21	26	29
Berkeley	14	21	46	17	23
Charleston	2258	3769	12216	3017	4197
Colleton	3	4	9	5	7
Dorchester	14	21	43	22	30
Georgetown	16	23	47	18	20
Hampton	-1	-1	-2	0	1
Horry	25	25	58	23	26
Jasper	3	5	11	8	9
Williamsburg	9	0	13	4	27
Georgia					
Bryan	3	5	11	17	14
Camden	-1	-2	-3	0	1
Chatham	262	302	379	268	222
Effingham	15	24	46	22	32
Glynn	2282	3526	3975	2961	2542
Liberty	17	22	38	23	20
Long	3	4	8	8	16
McIntosh	1	2	5	7	14
Florida					
Baker	9	14	26	12	14
Clay	20	29	55	23	25
Duval	2275	2752	4936	4099	4289
Flagler	1	1	2	1	2
Nassau	0	1	3	10	17
Putnam	12	18	37	20	26
St. Johns	6	9	17	10	13

The distribution of the population is closely related to the regions postulated in the scenarios as potential points for operating bases, gas processing plants, pipeline terminals and other sale related facilities, and, therefore, the population distributions are subject to the assumptions made for the various scenarios. The scenarios, although believed to be reasonable, are not the only reasonable scenarios that could be developed. The population impact projections can be viewed as a range of possible population changes that may result from activities relating to OCS Sale No. 43.

The population impacts developed with the use of Scenario D, which incorporates the high resource estimates, present an impression of small changes in population with the exception of the counties designated as the location of operations bases, oil or gas terminals, or gas processing plants. In these areas, relatively large population increases (more than 1000) occur, particularly in the case of Charleston County, South Carolina, where the population impact was estimated to increase from 2,258 in the year 1980 to 12,216 in the year 1988, diminishing to 3,017 in the year 1992, and increasing again to 4,197 in the year 1996.

The other population impacts are small, either increases of less than 50 persons, or small declines.

The population impacts developed by the use of Scenario B are generally smaller in scope. Chatham County, Georgia was projected as the county with the largest population impact. The population increase amounted to 2,209 in 1980, increased to 3,435 in 1984, and declined to 2,773 in 1996.

A summary of the population changes attributed to activities related to proposed Sale 43 will be found on Tables E-24, E-25, and E-26 for selected years.

The population changes that may result from proposed Sale 43 will occur as an incremental addition to population changes that may be due to other factors. In the following discussion, reference is made to the population projections published in the 1972 OBERS projections, based on the Series E projections.

The details provided in the OBERS projections are summarized for BEA 031 in Table E-27, which includes a six county area, incorporating Charleston, South Carolina. The projections include estimates for the Standard Metropolitan Statistical Area portions and non-SMSA portions of the BEA area.

These figures provide some basis for estimating the anticipated population changes within BEA 031 during the coming years. The population in the non-SMSA portion of the economic area is projected to decline by the year 1980, and to gradually increase through the year 2020, although not reaching the total attained during 1970. The population within the SMSA portion was projected to decline until 1980, and to increase after that year, surpassing the 1970 total between the years 1980 and 1985. The population within the total BEA area declines to a low point during the year 1980, and increases after that year, attaining the 1970 level between the years 1985 and 1990.

There are implications in these projections when an attempt is being made to estimate the effect that a proposed OCS sale may have on land use, demand for public services, availability of labor for OCS operations, and potential availability of facilities no longer required to serve the diminished population.

The population impacts associated with proposed Sale 43 within the six county area are summarized in Table E-28.

Extrapolating the BEA projected figures yields an estimated population of 428,780 persons in BEA 031 in the year 1988. In the event that the high population estimate would prove to be correct, the population impact related to Sale 43 would amount to approximately three per cent of the total population in the BEA 031.

Adding the high estimated impact of 12,334 to the estimated total population of 428,780 yields a total of 441,114 persons, approximately 9,441 persons more than 1970 population of the BEA.

In the event that the average population impact figure should turn out to be closer to the actual population increase that may develop as a result of Sale 43, the total population in the BEA would amount to 432,200 persons, approximately 527 persons more than the 1970 total population of the BEA.

The average sale related population increase of 3,420 amounts to slightly less than one per cent of the total projected population of 428,780 within BEA 031, as estimated from the OBERS data.

During the year 1988, the range of population impacts that may be experienced in Duval County, Florida range from a high of 4,936 persons to a low of −662 persons. The average population

Table E-24 Estimated Population Impacts

Summary of Five Scenarios (Year 1984)

State & County	High	Low	Average (rounded)
N. Carolina			
Brunswick	6	-2	0
Columbus	9	-8	-3
New Hanover	30	-4	5
Pender			
S. Carolina			
Beaufort	20	7	11
Berkeley	21	-14	4
Charleston	3769	30	1484
Colleton	4	-5	-2
Dorchester	21	-5	1
Georgetown	23	-6	1
Hampton	-1	-3	-2
Horry	25	-1	6
Jasper	5	-1	1
Williamsburg	10	-48	-14
Georgia			
Bryan	5	0	1
Camden	-1	-3	-2
Chatham	5318	191	2486
Effingham	24	1	6
Glynn	3526	-1	1407
Liberty	22	3	7
Long	4	0	1
McIntosh	2	0	0
Florida			
Baker	14	1	4
Clay	29	-4	18
Duval	2752	-8	1093
Flagler	1	-1	-1
Nassau	2	-1	1
Putnam	18	-6	0
St. Johns	9	-2	1

E-25

ESTIMATED POPULATION IMPACTS
Summary of Five Scenarios (Year 1988)

State & County	High	Low	Average (rounded)
N. Carolina			
Brunswick	10	-2	1
Columbus	20	-11	0
New Hanover	60	-4	12
Pender	24	-3	4
S. Carolina			
Beaufort	21	6	10
Berkeley	46	-23	0
Charleston	12,216	-352	3407
Colleton	9	-6	-1
Dorchester	43	-6	6
Georgetown	47	-9	6
Hampton	-1	-5	-2
Horry	58	-2	14
Jasper	11	-1	3
Williamsburg	13	-39	-9
Georgia			
Bryan	20	2	8
Camden	-1	-3	-2
Chatham	4474	379	2947
Effingham	46	2	12
Glynn	3975	-1	1485
Liberty	38	-70	-4
Long	8	0	2
McIntosh	6	-43	-5
Florida			
Baker	26	1	6
Clay	55	-9	7
Duval	4936	-662	1417
Flagler	2	-1	0
Nassau	4	-1	3
Putnam	37	-8	4
St. Johns	17	-2	3

E-26

Estimated Population Impacts
Summary of Five Scenarios (Year 1996)

State & County	High	Low	Average (rounded)
N. Carolina			
Brunswick	13	0	5
Columbus	13	-2	2
New Hanover	42	1	15
Pender	14	-1	2
S. Carolina			
Beaufort	29	-2	12
Berkeley	23	-21	-6
Charleston	4197	1	1681
Colleton	7	-2	0
Dorchester	30	-3	6
Georgetown	20	-6	1
Hampton	1	-3	-1
Horry	25	-1	13
Jasper	11	2	7
Williamsburg	34	-29	15
Georgia			
Bryan	44	-17	9
Camden	1	-1	0
Chatham	4170	222	2634
Effingham	32	2	11
Glynn	2542	-3	735
Liberty	20	-64	-7
Long	16	1	7
McIntosh	14	-64	-5
Florida			
Baker	14	2	5
Clay	25	-13	-1
Duval	4289	-469	1234
Flaglar	2	0	1
Nassau	17	5	10
Putnam	26	-2	3
St. Johns	13	-1	3

Table E-27 Population BEA 031 Charleston, South Carolina

Year	SMSA Portion	Non SMSA Portion	Total BEA Area
1970	304,493	127,180	431,673
1980	297,500	110,400	407,900
1985	308,500	112,400	420,800
1990	319,600	114,400	434,100
2000	332,200	115,400	447,600
2020	365,900	120,900	486,900

Note: Minor discrepancies presumed due to rounding.

Table E-28 Population Impacts 1988

County	High	Low	Average
Beaufort	21	6	10
Berkeley	46	-23	0
Charleston	12,216	-352	3407
Colleton	9	-6	-1
Dorchester	43	-6	6
Hampton	-1	-5	-2
	12,334	-386	3420

impact calculated from the five runs amounts to 1,417 persons.

The total high sale-related population impact in the counties of Baker, Clay, Duval, Nassau, and St. Johns amounts to 2,806 in the year 1984, and 5,038 in the year 1988.

The population data projected in the OBERS Series E reports are summarized in Table E-29.

BEA 034 encompasses an extensive geographic area, extending from the Atlantic coast of Florida to the Gulf of Mexico, and extending northward into Georgia. The Jacksonville SMSA includes Duval County, Florida, and probably provides a more realistic basis for estimating population impacts.

The OBERS projections indicate that the population of the Jacksonville SMSA is expected to increase, as shown on the above table. Based on the projections shown, the population in the Jacksonville SMSA in the year 1988 could be expected to number 706,820. In this case, the anticipated high population impact of 5,038 persons would amount to less than 1 per cent of the anticipated population in the Jacksonville SMSA in 1988.

Chatham County, Georgia is included within BEA 033, an area containing a large number of counties centered on the city of Savannah, Georgia. The population projections for this area, as well as the Savannah SMSA as published in the OBERS publications, are contained in Table E-30.

The projected population of the Savannah, Georgia SMSA during the year 1988 would amount to approximately 198,280 based on the above projections. The maximum impact estimated in Bryan, Chatham, and Effingham counties in 1988 amounts to 4,540 persons, approximately two per cent of the estimated population in the SMSA during the year 1988. During the year 1984, the high estimated population impacts in the three Georgia counties amount to 5,347 persons. The high impact estimate amounts to approximately three per cent of the projected 1984 population in the SMSA.

The Economic Development Profile, prepared for Brunswick, Georgia by the Georgia Department of Community Development, noted that the population of Glynn County, Georgia amounted to 50,528 during the year 1970, and if the population in the county should increase in the same proportion as the non-SMSA portion of BEA Economic Area 033, the population of Glynn County is projected to amount to 52,500 in the year 1984, and 53,206 in the year 1988.

The high population impacts due to proposed Sale No. 43 on Glynn County, Georgia as estimated by the scenarios calculated for this impact statement amount to 3,526 in the year 1984 and 3,975 in the year 1988, approximately 7 per cent of the total projected population for these years.

It is difficult to form a concise, and unequivocal estimate of the population changes that can be expected to occur in specific areas, or locations, in the four state area adjacent to the sale area pertaining to proposed OCS Sale No. 43. The primary sources of difficulty are due to uncertainty regarding the extent of exploration and production activities that may result from the sale, and the onshore locations that may be selected as sites for pipelines, support facilities, and terminals, as well as the employed persons choice of areas in which to establish their homes.

Some examples of factors that could be included in plans developed to provide facilities required as a result of activities to proposed Sale 43 have been partially developed in the above discussion.

The employment and population effects of the proposed sale could, in part, replace population migrating away from specific points due to causes having little or no ties to OCS operations. The effects could also take place in an area experiencing increases in population due to causes having little, or no tie to OCS operations.

The scenarios chosen for inclusion in this impact statement represent a small section among many possible alternative development scenarios, and the results of these scenarios incorporate estimates and procedures that may differ from those selected by other entities in order to develop other estimates of economic and population impacts.

The results of these scenarios indicate changes in the population levels which are generally small in scale, amounting to changes of one or two per cent, measured by the maximum estimated population change anticipated in an area. The use of average, or low, estimated population changes would have diminished the anticipated impact.

In the event that additional lease offers are made on the OCS adjacent to the South Atlantic states, and economic quantities of oil and gas are produced as a result of this sale and additional possible sales; higher levels of employment, and

Table E-29 Population Projections (OBERS - Series E)

Year	BEA 034	Jacksonville, Fla. SMSA
1970	1,057,007	531,592
1980	1,234,100	619,700
1985	1,326,500	672,500
1990	1,425,700	729,700
2000	1,569,900	815,500
2020	1,813,700	964,800

Table E-30 Population

Year	BEA 033	Savannah, Georgia SMSA 207
1970	418,897	188,275
1980	423,400	186,900
1985	434,400	193,900
1990	445,700	201,200
2000	452,000	208,900
2020	463,500	223,000

related higher levels of population, than those estimated to result from proposed Sale 43 operations could result. The extent of these possible higher levels is difficult to predict due to the uncertainty concerning the time frame in which these events could occur.

For instance, if drilling operations related to proposed Sale 43 coincided with drilling operations related to another subsequent sale, the population impact could be greater than that projected for the initial sale.

For example, with reference to Table E-21, Scenario D indicates a peak population impact of 22,111 during the year 1988. The population was projected to decline to 10,680 in 1992, leading to an estimated decrease of approximately 2,858 persons per year. In the event that a subsequent sale held two years later produced an identical population impact pattern, with a peak in the year 1990 rather than 1988, the effect of these two distinct population estimates would be to produce a stable number of persons during the years 1988, 1989, and 1990, followed by annual declines on the order of 6 thousand persons annually.

The maximum level of population impact in this case would be less than twice the maximum anticipated from a single sale, amounting to approximately 87 per cent at this value, in this example.

The cumulative population impact that would be expected to result from multiple sales in the South Atlantic region would be annual impacts higher than those anticipated from a single sale, but would exhibit more gradual increase and decrease than would be expected from a single offering of leases.

The population impacts associated with sales in the South Atlantic and Mid Atlantic states would be limited to those areas selected as locations for support facilities and terminals for production developed in adjacent OCS areas.

Crude petroleum produced from leases awarded in the South Atlantic states may be transported to refineries located in the Gulf of Mexico region, or possibly, to refineries located in the southerly portions of the Mid-Atlantic states. In this case, activities in the South Atlantic area would have an economic effect outside the area adjacent to the sale, but would mean the substitution of domestic crude oil for imported crude petroleum in existing refineries.

5. Impact on Land and Air Transportation

All of the ports within the region which might become the locations of offshore service centers are connected to the interior and the remainder of the nation by rail and highway networks. Both systems will be able to handle any increase in cargo and passenger traffic generated by all phases of the proposed sale. Many pieces of equipment for drilling, construction of offshore wells and platforms, and for the laying of pipelines are commonly moved by land transportation systems. Using the low production estimates the most impacted ports will be Charleston, Brunswick and Jacksonville. All of the major ports of Charleston, Savannah, Brunswick and Jacksonville will likely have service centers in or near their port facilities if the high estimate of production is reached. During the exploratory and development phases resulting from the proposed sale there would be an increase in rail and highway traffic towards and along the coast between the above mentioned cities as material and equipment are brought into the area and shifted along the coast to meet the demands of the various offshore service facilities. The increase in highway traffic should be well within the main and secondary road system's capabilities. Much of the initial equipment needed during the beginnings of the exploration will likely be carried on board the drilling rigs as they are moved by water transport from their former locations. Additional material in large quantities or bulk would probably be barged up the Intracoastal-Waterway or be shipped by rail. The increase in barge and rail traffic would probably be the most substantial. The increase should be well within the capacity of the transportation system's abilities.

Air traffic can expect minor impacts from the movement of supplies and personnel into the area. Airports in or near the offshore service facilities mentioned above will receive a moderate increase in the amount of air traffic presently experienced as helicopter traffic develops along with offshore development. Helicopters are a common form of transportation used for the movement of personnel and light equipment. For the lesser development estimates probably three heliports will be established, at Charleston to serve the northernmost set of tracts, and at Brunswick and Jacksonville to serve the larger area of tracts to the south. For the greatest expected development in the

OCS up to 15 helicopters may be distributed among the four service bases at Charleston, Savannah, Brunswick, and Jacksonville. For the region as a whole this does not constitute significant increase in air traffic, but for the service bases and surrounding areas this will have an impact on other air traffic by increasing the number of aircraft in the air during the day.

Scheduled airlines can expect a beneficial impact to occur as personnel and air freight traffic increases as a result of the proposed sale. The most heavily impacted airports will probably be those at Savannah and Jacksonville.

The impact on land and air transportation will be minimal, all systems are currently capable of handling any increase brought on by this sale.

The cumulative impact of this and other Atlantic Coast sales will be an increase in the loads on transportation systems. These impacts, though minor, when coupled with possible future sales will increase the demands for surface and air transportation. Once the industry has become established along the coast in response to successful exploration the impacts on air travel should lessen while those on highways, rails and canals will increase.

6. Impact on Recreation Areas and Activities

Stationary marine environments such as specially designated marine preserves and unique shallow water areas noted for water clarity and displaying attractive sedentary undersea features such as coral and historic shipwrecks are very susceptible recreation resources to marine pollution induced by oil and gas activities. Water dependent recreation activities such as swimming, fishing (discussed separately), waterfowl hunting, snorkling, skiing, sailing, etc. are also susceptible to severe impacts from marine pollution induced by oil and gas activities especially in shallow water, near shore areas available for recreation use.

Likewise parks, wildlife refuges and management areas, specially designated areas such as national natural landmarks, National Register sites, beaches and barrier islands and other shoreline recreation resources that front on the Atlantic Ocean or its bays and estuaries can also incur impacts from pipeline construction which comes ashore, from oil spills and from the placement of onshore facilities (such as production terminals or transfer facilities) should they be located in or near a recreational area. Additionally oil and gas activities offshore can visually impact on shoreline resources or contribute non-petroleum floating debris to ocean waters that eventually washes ashore impacting recreation resources and water enhanced recreation activities.

In summary there are six major recreation activities and 74 designated areas under national and state jurisdiction with ocean and sound frontage susceptible to impacts from oil and gas activities in the South Atlantic OCS (see Visuals 1N & S).

By far the most unpredictable negative impact can result from oil released into the marine environment which finds its way into popular recreation waters or reaches shore soiling shoreline recreation resources. Oil spills most likely to affect recreation resources and activities could originate from drill site blowouts, near shore or onshore pipeline breaks or leaks, and crude oil transport vessel accidents, or a non-dramatic combination of all these causes often called chronic pollution.

More predictable and controllable impacts can result from onshore facility requirements such as pipeline alignments, support facility sitings and the aesthetic affects of these type facilities upon people recreating within perceivable distance from these facilities.

It has been assumed, for purposes of this discussion, that if noxious hydrocarbon products find their way into nearshore waters and shoreline areas it will impact recreation areas and consequently recreation use. Such impact can cause additional impacts on outdoor recreation related tourism and ultimately on local economies. As noted in Section II and vividly apparent on Visuals 1S and 1N most of the South Atlantic coastline is used for public and private recreation purposes. The area directly shoreward from the offered lease tracts corresponds generally to the shoreline between Georgetown, South Carolina and Jacksonville, Florida. Within this 500 km coastline is a concentration of wildlife and natural areas, recreation beaches, recognized historic sites, and state parks. Most notably are Georgia's eight major sea islands which vary in recreation use from the highly developed, multi activity Jekyll Island State Park to the heavily forested uncluttered natural setting found on Cumberland Island, a component of the national parks system. Besides the major concentration of historical areas in the Charleston vicinity, Cape Romain Na-

tional Wildlife Refuge and state parks at Hunting Island and Edisto Beach dominate the coastal recreation setting along the South Carolina seashore south of Georgetown. Little Talbot Island and Fort Clinch State Parks and Aquatic preserves typify the Florida coastline north of Jacksonville. As the closest points between potential production areas and land lies within this arc between Jacksonville and Georgetown it is probable that pipeline landfalls and shoreline support facilities would impact within this area. Industrially zoned land already exists within this same area logically suited for operation bases needed to support this proposed sale. These bases presumably do not presently compete with recreation interests and there are no clearly identifiable factors associated with this proposed sale that would lead us to conclude that onshore facility needs would unduly compete with current or future recreation needs. Pipeline landfalls between offshore production areas and onshore storage and transport areas could also conceivably impact on recreation areas and activities. Such impact should be minimal as a short timeframe is required for pipeline implacement (underground) and should be restricted to a narrow route. According to government regulations rights-of-way are not to exceed 60 m. Two to four oil/gas pipelines are estimated to result from the proposed sale. (USGS, 1976) and would be designed to avoid important recreation areas and designed and constructed so as to soften the short term and long term impacts to shoreline resources. Additionally, the pipeline laying operations, and onshore facility construction activities could be undertaken during the time of year when recreation use is least likely, usually during the winter. As is pointed out in Scenario D (Section III-5-1) the probable impact from transportation facilities, should any occur, will most likely be confined to a range within or on either side of Charleston harbor and/or Jacksonville harbor. Even though recreation use such as beach activities are concentrated on beaches in the vicinity of major population concentrations such as Charleston and Jacksonville the risk of affecting recreation opportunities will be negligible as sufficient idle beach and shoreline recreation resources are available to accommodate any temporary displacement by pipeline corridors construction or additional vessel transport. Viewed differently of the 80 miles of shoreline identified as potential transportation impact area less than one half mile should be affected as a result of product and support embarkation and landfall support facilities associated with this proposal. Consequently, onshore support facilities should have negligible, and in the case of pipelines, short term impacts on recreation opportunities and whatever minimal impacts do occur will be confined to small localized areas.

Oil spills resulting from drill site blowouts, tanker accidents and pipeline failures will have severe impacts on any recreation areas which are directly soiled by the spill. As a floating substance oil slicks are mobile and tend to have the greatest affect on water surface and shoreline areas. Additionally, factors such as wind, wave actions, currents, most notably the Gulf Stream, and speed and effectiveness of containment actions can affect the impact of oil slicks on recreation.

The oil spill risk analysis model in Section III.A.5. indicates that a spill emanating from near the center of the proposed lease area would most likely travel a course parallel to the coastline either to the north or south. Climatic and oceanographic factors affect the rate and direction a spill will travel therefore the model predicts beaching locations and time lags for various sized spills occurring during the four major seasons. The results of the model indicate the beaches and recreation areas lying between Jacksonville and Cape Canaveral to the south and those resources between Wilmington and Nags Head to the north are most vulnerable to potentially damaging oil spills because of predictable spill trajectories. Even though a spill would likely reach shore faster in the autumn and fall than in the summer and winter, lease site spills are predicted to take at least two weeks to reach shore. Natural dissipation in addition to containment efforts should eliminate sufficiently most major spill threats to shoreline recreational resources within that minimum time frame.

The risk analysis indicates however there is a 92% probability that at least one spill greater than 1000 bbls will impact somewhere on shore during the production life of the lease areas (estimated at approximately 25 years). Furthermore, it is very probable such a spill would affect a sandy beach but there is a low probability a designated public recreation area would be affected. Depending on the production area or transportation route selected probability of an oil spill impacting vari-

ous resources and areas associated with recreation use is predicted to range as follows: sandy beaches, 69-97%; recreation areas, 12-21%; wildlife refuges, 1-5%; historical sites, 4-19%; and sport fishing areas, 1-3%. Table A-12, Section III provides a more detailed analysis on the source specific oil spill impact probabilities.

When considering probabilities of spills coming from pipeline or tanker transport systems some portion of the extensive sandy beaches of the South Atlantic will very likely be affected whereas there is less than a 50% chance a designated recreation area will be impacted. The analysis shows only a slight advantage in protecting recreation resources should specific pipeline transportation systems be utilized instead of a vessel transportation system with the same routing.

The Matrix analysis in Section III.F.4. provides similar conclusions as regards potential impacts on recreation resources from lease site structures and oil spills. Primarily because of distance from the beachfront outdoor recreation areas, shoreline aesthetics show no potential impact from projected structures and only minimal potential impact from possible oil spills.

In general, marine recreation resources such as marine preserves and reefs not associated with a corresponding land base could be only minimally affected as most of the pollutants remain in the top portion of the water column and will tend to move out of the area in a short period of time. Potential users will avoid such areas until the spill and its effects have been removed. Undersea features such as coral, sponges, other biological organisms or even cultural resources should not be greatly affected by such an occurrence. Other sections of this statement discuss impacts on marine biological and cultural resources. Potential exists for oil slicks reaching the established Federal marine preserves and Florida state water preserves, especially those between Cape Canaveral and Jacksonville. A tanker accident away from the lease tracts could more likely affect an established marine preserve. Even then the impact should only be temporary unless the spill is major and climatic conditions hamper effective containment operations.

More susceptible to persistent and damaging impacts are shoreline recreation resources where oil spills have come ashore. Because of the number and extent of public and private recreation resources along the South Atlantic with ocean and bay frontage it is likely that any major spills that eventually come ashore will impact on recreation resources. The greatest number of recreationist would be affected should an oil slick come ashore on a national seashore or a popular recreation beach where the focus of public use is at the water's edge. Of the 1900 km or approximately 1200 miles of beachfront potentially affected by the proposed sale major dedicated ocean front recreation sites are located in areas where spills are most likely to beach. Specifically Cape Hatteras and Cape Lookout National Seashores to the north and Cape Canaveral National Seashore and Anastasia, Frank Butler and Flagler Beach State Recreation Areas to the south are located in high potential beaching sites according to spill trajectory predictions. Likewise state parks and state aquatic preserves along the northeastern shoreline of Florida are most susceptible to damage from spills beaching in the identified probability areas. The areas include Fort Clinch State Park and Aquatic Preserve; Nassau River State Aquatic Preserve, Little Talbot Island State Park; Tomoka State Park and Aquatic Preserve; and Mosquito Lagoon Aquatic Preserve. Water sports such as swimming, wading, skiing, fishing for finfish and shellfish would be directly affected as well as onshore activities such as beach play, camping and picnicking. Cape Hatteras National Seashore for example has 70 miles of ocean frontage and was visited in 1975 by over 1.5 million people. Almost all of these visitors were interested in waterfront enjoyment. Should this use be curtailed because of a major oil beaching, secondary impacts would ensue to the local economy as well. Soiling of wildlife lands, historic sites and natural area shorelines would probably affect fewer recreationists but could be severely detrimental to the resource itself. Not only could the vegetation and wildlife in the localized area be affected to the point of wide spread mortality but small amounts of hydrocarbon ingested by migratory species such as ducks could eventually affect breeding success.

Experience has shown (Santa Barbara Spill, 1969 for example) that although beaching of oil spills can be severly damaging in the short term the effects can be overcome in time. Removal of oil from recreation beaches would probably involve removal of the contaminated sand and replenishment with replacement or cleaned sand.

Emergent and submergent vegetation severely damaged will usually revive from the original rootstock during subsequent growing seasons assuming proper cleanup efforts.

Recreation areas and activities also would be affected where chronic low-level discharges have caused a degradation of the environment. The sand beaches, barrier islands and designated shoreline recreation resources of Georgia and South Carolina are less susceptible to dramatic spills as well as chronic small scale spillage (0-1000 bbls, average 3 bbls) resulting during the production life of the proposed lease areas. Figure A-15, Section III shows total quantities of petroleum residues expecting to come ashore over the 25 year production life as ranging from 500 - 1,000 grams per meter of beach along the northeastern Florida coast and places in North Carolina to less than 100 grams per meter near the Georgia-South Carolina border.

Studies by Dennis (1959) and Morris (1973) have documented the occurrence of petroleum residues, commonly referred to as "tar lumps" or "tar balls" as an increasingly chronic problem in the Atlantic Ocean which is affecting Atlantic coastal beaches. A chemical analysis of beached tar lumps by Morris led him to conclude the major source of these pollutants were tanker washings. Quantitative analysis of residues by Dennis led him to conclude that the annual increment of petroleum residues occurring on South Florida beaches was around 600-700 g/m or approximately equivalent to the projected cumulative buildup of residue at the most severely impacted beaches resulting from 25 years of production from the proposed lease sale (Table A-15, Section III).

The Dade County Parks and Recreation Department and the Miami Beach Parks Department have indicated chronic tar ball residues are not a serious problem affecting recreation use of South Florida's public beaches. The U.S. Coast Guard station in Miami indicated they receive complaints from time to time indicating tar balls are a nuisance to recreationist enjoying beach activities in the South Florida area.

Seasonality is another factor which can significantly contribute to the impact of oil spills on recreation. Spoiling a South Carolina vacation beach, the Grand Strand area for example, will have a greater impact on recreationist during the spring or summer as will the spoiling of a bayfront wildlife management area such as Merrit Island National Wildlife Refuge, during the mid-winter waterfowl season than would a similar occurrence during the off seasons. Assuming off season shoreline contamination where a successful cleanup is rapidly effectuated, positive publicity could be generated to limit both the scope and duration of potential impacts to recreationist.

The aesthetic character of a given area or resource although difficult to qualify because of value judgment involved is another potential impact resulting from oil and gas activities. Whereas the sight of an offshore platform may bring excitement and anticipation to an offshore fisherman other recreationist would be obviously offended by the sound, sight or smell of offshore energy development. The establishment of an oil or gas related facility for example within apparent perception of the designated wilderness portions of Cape Romain National Wildlife Refuge may be a violent intrusion to the visitor seeking solitude in such a coastal setting.

The major significant potential aesthetic impact resulting from offshore activities as a result of the proposed sale will be oil spill-induced. Drilling and production activities which may take place in the area of the currently selected lease tracts will-not be perceptible from shore because of the distances involved. The beaching of oil, whether from drill sites, pipeline spills or vessel accidents will cause negative visual impacts limited to the areas affected and lasting until clean-up can be completed. The most likely potential for spilled oil which could soil shoreline recreation resources would result from a vessel accident transporting crude between a lease site production area and a shoreline destination point. Final decision on crude transport systems will not be made until discoveries have been made and production quantities are defined.

Aesthetic impacts could result also from placement of oil terminal/storage facilities, gas processing plants and pipelines. The placement of these types of facilities along beaches and shorelines and within wetlands should it be allowed by the states may well create perceptible obtrusive effects to recreationists. Generally, such effects would be localized unless sitings were made on undeveloped shoreline in flat terrain with low vegetation cover where impacts could be more far-reaching.

It should be noted that recreation and tourism are very interrelated. Many of the coastal economies along the South Atlantic are heavily dependent on the quality and attractiveness of ocean and bayfront recreation resources. Should recreation areas be impacted to the point of discouraging public use as a result of this proposed sale, a corresponding impact would be noted in the economies of coastal towns and villages. The extent of economic harm which may result from an oil spill affecting recreation resources would be impossible to predict with any degree of specificity because of the importance of interplay factors previously discussed (spill size, duration, seasonality, locale, etc.). Likewise, the tourism industry is highly dependent on a reasonably priced personal fuel supply.

Some additional effect on the recreation industry can be implied from the output data produced by the Harris Multiregional Multi-industry Model (see Appendix K).

The data in Table E-30.1 were selected from the estimates provided by Scenario D, the base scenario. Industry Sectors 84 and 87 include motels, personal services and repair services and amusements and recreation (see Table E-30.1).

The projections in Table E-30.1 indicate a modest increase of employment in these industries and increasing recreation oriented personal expenditures.

Removal of open space, increases in employment and personal income and population expansions resulting from oil and gas development of the Georgia Embayment could cause secondary or indirect impacts to existing or proposed recreation facilities and resources. These same factors could limit public appreciation by increasing competition and straining carrying capacities for those resources currently available. Total land needs directly related to the petroleum industry's onshore support facility requirements were estimated not to exceed 220 acres. Likewise population and earnings are not projected to be significantly affected when considering the South Atlantic region as a whole. Consequently secondary impacts on recreation are projected to be minimal when considering the economic and land modification effects on the broad South Atlantic Seaboard.

Impacts may well be noticed in specific areas where employment, earnings and land use are appreciably affected. (See Section III.E.1., 2., 3. and 4.) By noting which areas receive the greatest economic impacts, one can presume a corresponding indirect impact on recreation. In general, indications are that petroleum development of the Georgia Embayment will be capital intensive as opposed to labor intensive. Assuming encouraging exploration results, increases in employment and population should be gradual in areas affected affording sufficient time to mitigate potential indirect impacts on recreation.

In summary, given the possible oil pollution events the potential exists for: (1) short term loss of water related, near shore recreational activities, (2) oiling of beaches and recreation areas especially between Jacksonville and Cape Canaveral and Wilmington and Nags Head; (3) short term decreases in tourism based economies; and (4) aesthetic disturbances to a certain segment of the population. Furthermore when considering the recent Baltimore Canyon sale and the pending and scheduled hydrocarbon lease sales planned for the mid and south Atlantic OCS areas the probability, magnitude and frequency of pollution causing events affecting shoreline recreation resources and activities, especially along the outer banks of North Carolina also increases.

7. Impact on Sport Fishing and Recreational Boating

There is an extensive fishing and boating interest which utilizes the sounds and nearshore areas along the South Atlantic seaboard. Most recreational boats other than sailboats are also utilized by sport fishermen. Additionally North Carolina, South Carolina, Georgia and Florida all support charter and party boat fleets which range throughout the Outer Continental Shelf engaging in sport fishing activities.

The most pervasive adverse impacts on boating and fishing stemming from hydrocarbon development in the South Atlantic OCS would probably involve pollution to the marine environment. The most damaging cause of marine pollution would likely result from chronic or dramatic spillage of oil. Boaters and fishermen would not want to soil their boats by entering a contaminated area for the duration of a spill incident. Additionally, a major oil spill could have a longer term impact on sport fishing if the larvae or basic components of the sport fish food chain were diminished as a result of a spill. Sections III.B.1.a.d. and C.4. and Appendix I address the impact of oil spills and

Table E-30.1 Estimated Recreation Impacts
Jobs (Industries 84, 87)

State	Year				
	1980	1984	1988	1992	1996
Florida	2	8	26	35	44
Georgia	5	14	18	21	27
South Carolina	0	0	1	2	30
North Carolina	0	0	0	1	2
Total	7	22	45	59	103

Personal Consumption Expenditures
(thousands of dollars)

Florida	493	623	1046	901	985
Georgia	491	762	872	709	645
South Carolina	412	695	1887	541	778
North Carolina	3	3	2	6	10
Total	1399	2083	3807	2157	2418

hydrocarbon pollutants on the biological communities supportive of saltwater fisheries. Even in the case of major oil spills long term toxic environments would not be maintained and fish populations would be expected to migrate back into affected areas once the oil slick has been removed (by wave action, containment, and cleanup or dispersion). Repopulation of an area could be anticipated to be well underway by the end of the succeeding spawning cycle. In sport species such as mackerel, bluefish, cobia, flounder and seatrout, sport fishing should not be affected for a longer period than one year in any one spill area.

Based on the sensitivity analysis presented in Section III.F.4. known fishing grounds on the Outer Continental Shelf are likely to receive maximum adverse impact from structures which might be erected on 17 offered lease tracts and from oil spills from five offered lease tracts. Recreationists most likely to be affected by these impacts are fishermen who utilize charter or party boats.

Aside from damage caused by oil spills, there is considerable evidence that oil and gas operations have an overall favorable impact on sport fishing activities (Seymour 1975; Shinn, 1974; Gurc, 1974).

One favorable impact is the result of sport fish concentration due to the artificial reef effect of offshore platforms. In the open sea, offshore platforms provide both food and cover in areas that are largely devoid of those essentials. Myriad forms of microorganisms in the water drift by these structures and attach themselves, soon encrusting all exposed surfaces on the platform. Hard substrate is necessary for encrusting organisms: barnacles, hydroids, corals, mussels and other invertebrate organisms which serve as links in the food chain. Some researchers such as Matthews (1966) have gathered evidence indicating, artificial reefs contribute to an increase in productivity. Randall (1968) has stated that artificial reefs provide protection, food sources, spawning sites and spatial orientation markers for fishes. The same author found that artificial reefs attract available fish from surrounding waters, and increase the size of some populations by providing additional protected areas and food for both the young and adults. The typical platform located in 30 meters of water will have a surface area of about 0.8 hectares (over 8,082 square meters) (Shinn, 1974). Other advantages of these structures is the free movement of water through and around them and their high profile. The high profile provides habitat for a wide variety of fish ranging from the turbid dark bottom zone to the lighter and clearer surface waters. Platforms are easily located by boaters and fishermen and the platforms and their personnel are a source of emergency assistance for all offshore sportsmen.

In offshore Louisiana and Texas where oil and gas operations have been ongoing for approximately 30 years, platforms, which number over 2,000, are the major focus of individual sport fishermen, charter and head boat operations and scuba diving expeditions. Divers are drawn to these stuctures for spear fishing, underwater photography and general pleasure diving. The submerged portion of structures contribute to safety by assuring the diver's orientation to depth and distance (Estopinal, 1975).

The 10 to 25 platforms which are projected for construction as a result of this proposed sale should have a similar positive impact on sport fishing. However, offered tracts in this proposed sale are confined to areas ranging from 50 to 120 km (30-72 miles) from shore. When considering the time and safety factors involved in venturing such distances from shore for pursuit of sport fish it is likely that sportfishing opportunities resulting from the reefal effects of platforms constructed will only be minimally affected. Charter and head boats and those that are currently equipped to travel far distances from shore in pursuit of deep sea fish may find the platforms to be additionally productive sport fishing areas in 5 to 10 years from the proposed sale date.

Results of this proposed sale are projected to have negligible effects on inshore boating and sport fishing. Other than a temporary decline in localized fishing activity from oil slicks in near shore areas the possible construction and use of 160 to 320 miles of pipeline to transport oil and gas finds could have minimum short term effects on inshore fishing and boating areas resulting from temporary disturbance of the bottom sediments, however, no more than three landfalls are projected to result from this proposed sale (USGS, 1976). Stipulations regulating pipeline construction methods require burial of all pipelines out to water depths of 61 meters (200 ft.). Thus it is unlikely that pipelines resulting from this proposed sale would snag lines of sport fishermen or interfere with boat anchors.

In addition to pipeline landfalls, dredging and filling activities and increased runoff resulting from onshore support facilities could have noticeable short-term impacts on larval populations and boating aesthetics, but the overall impacts on sport fishing and boating would be negligible. The size of larval kills and catchable fish out-migrations caused by the turbidity associated with these activities would be influenced by the size of the area affected, as well as the seasonality of occurrence. Assuming there is no permanent turbidity and bottom sediment modifications associated with these onshore and nearshore activities, fish populations and recreational boating would attain almost complete recovery in the recreation season following the temporary disturbance.

Access to recreational waters by boaters and fishermen will not be noticeably affected as a result of this proposed sale.

In summary oil spills and facilities constructed in the marine environment are projected to have minor localized, and temporary adverse effects both offshore and nearshore on boating and sport fishing in the South Atlantic. Although leasing of oil and gas rights in the Mid-Atlantic and additional sales in the South Atlantic may increase these potential pollution causing factors the cumulative effect of widespread platform developments throughout the Atlantic OCS should eventually attract many sport fishermen and stimulate the recreational boating industry.

8. Impact on Onshore Cultural Resources

Onshore development resulting from this proposed sale could negatively affect cultural resources. The building of onshore bases, natural gas processing plants, and trenching for pipelines might destroy or disturb the undiscovered remains or artifacts of early Indian groups and colonial occupations. Oil spills from pipelines onshore could seep through the ground and coat artifacts, adversely affecting their value and usefulness as well as discouraging public appreciation of these resources.

The 56 historic sites enumerated in the cultural resource section (II.G.6.e.) some of which are mapped in Visuals 1N and 2S are in a position where they could be affected by oil spills coming ashore in their vicinity, or by the construction of onshore facilities. Those sites which are shown further inland on the Visuals could be affected only by the construction of onshore facilities.

Should an oil spill occur and the oil were to come ashore near a historic or archaeological site, oil on or adjacent to a cultural resource would have a short-term visual impact, assuming clean-up operations could remove the oil within a reasonably short time. Long-term impacts and actual distribution of artifacts could occur if spilled oil was to impregnate dateable organic matter in a prehistoric living site. Oil residue, even after clean-up operations would affect the carbon dating procedures used to analyze the material.

Adverse long-term impacts to the visual environment of a cultural resource may be caused by the construction of onshore facilities adjacent to that site. For inland sites the greatest probability of impacts occurring will be near the port cities of Charleston, Savannah, Brunswick, and Jacksonville, where the probability of siting onshore service and petroleum processing facilities is higher.

Adverse short-term visual impacts could be caused by the burial of a pipeline near a cultural resource. Under normal circumstances the visual effect caused by the trenching and burial operation is quickly modified and eventually hidden by the natural vegetative growth process of the particular environment.

State environmental and regulatory agencies have responsibilities for pipeline siting approval and opportunities to review plans for onshore development related to offshore activities. Section 307, 16 USC 1451 of the Coastal Zone Management (CZM) Act as amended will require lessees to file a certificate with the adjoining state certifying that proposed development plans are consistent with that state's CZM program once such a program is adopted and approved. Special stipulation number 4 (Section IV.D.) and proposed OCS Order No. 15 (Appendix G) are being recommended as interim measures which will allow states without an approved CZM program to plan for and avoid predictable onshore impacts from exploration and development of tracts leased. The State Historic Preservation Officer's (SHPO) staff, in reviewing plans can make comments pertaining to project related impacts. The SHPO staff serves in an advisory capacity and can make recommendations as to measures necessary to mitigate the impacts on affected cultural features. This could serve to greatly reduce the potential impact of OCS related onshore activities. It is the responsibility of the Federal government however

to assure protection and mitigation of offshore and onshore cultural resources predictably impact as a direct result of offshore leasing.

We do not foresee that visual impact on any historic sites along the coast would be caused by the visual intrusion of exploratory drilling or other developmental equipment into the line of site. The highest piece of exploratory drilling equipment is a semi-submersible drilling rig, the top of whose derrick stands about 64 m above the water surface during operations. In theory the very tip of the derrick could be seen protruding over the horizon if the rig was 26 km away from a person standing at sea level on the beach. In actual practice, the rig would have to be much closer for it to be visible due to atmospheric interference, wave height, and the resolving ability of the human eye. The most massive and therefore visible part of a rig does not extend more than 36 m above the water surface, and a rig would have to be closer than 20 km from shore to be visible. There are no plans to offer tracts any closer than 48 km from shore. In theory again, a person standing 40 m above the beach could see the top of a rig at that distance, but in practicality, atmospheric conditions and resolution limits of the human eye would mask the image.

The result of offshore operations would therefore be no visual impact on coastline cultural resources due to the intrusion of offshore equipment into the lines of site because of the distance involved. Any site located directly on the coastline has the potential of being impacted by contact with an oil spill, or by being temporarily visually impacted by being within visual distance of a spill.

According to the OCS oil spill risk analysis model two areas along the coast had the highest probabilities of having oil spills come ashore. If a spill were to occur and if it were to behave like one of the trajectories used in the model there would be between a 20% and 23% chance of it coming ashore along a stretch between Cape Canaveral and the Florida, Georgia border, and there would be a 23% chance of a spill coming ashore between Cape Romain and Cape Fear. Historic and archaeological sites along those coastal stretches therefore would have a higher probability of being impacted visually or by contact with an oil spill. The remainder of the coast would have lesser probabilities, the lowest (3%) of which is in the stretch of coastline between Savannah and the Georgia, Florida border.

The location of the origin of the spill also may cause variations in the locations and probability of an impact. According to the model, if a spill originates in one of the southernmost tracts proposed for leasing there is a seven percent probability that a cultural resource along the coast will be impacted. Should the spill originate in one of the northernmost least tracts the probability of cultural impact is higher, up to 19%. These impacts of course are based on the assumption that clean-up activities do not intercept the spill. Thus in reality all percentages should be lower.

The matrix analysis (Appendix J) summarized in Section III-F., which is based on water depth and distance of the tract from shore indicates that there will be minimal impact on onshore cultural resources caused by structures or spills associated with this proposed sale.

Offshore structures will not visually impact coastal sites because of the distance from shore to the proposed lease tracts. The construction of onshore facilities and pipelines will not impact cultural resources because state historical preservation specialists will review all development plans prior to construction. There is a probability that between 7 and 9% oil spills reaching shore could adversely impact pre-historic living sites located within the tidal zone by contaminating them.

9. Solid Waste

a. Offshore

Proposed South Atlantic OCS Order No. 7 requires that no solid waste materials or debris be disposed of in the marine environment, but must be incinerated or transported to shore for disposal according to governmental regulations. Based on 4.5 lbs of solid waste/person/day (estimates range from 3.3 lbs to 6 lbs, Snyder, 1974; CEQ, 1974), the maximum waste generated offshore in the South Atlantic OCS as a result of the proposal during peak production years would be approximately 13 tons/week (662 tons/year). In relation to industrialized areas such as Jacksonville, Savannah and Charleston the amount of solid waste that would be generated offshore would be negligible. For less populated areas such as Flagler County, Fla., and McIntosh County, Ga. the solid waste generated offshore would be less than 13% of the amount generated in these areas. At times other than peak production, the additional increases in annual waste loads would be smaller.

The other source of offshore solid waste resulting from this proposed activity would be that generated during an oil spill cleanup operation. This would include oil impregnated sand, synthetic tapes, foam, straw, chips, etc. The amount of this material would be dependent on individual spills and the particular area involved. Though volumes are not computable at this time, the disposal of this type of waste could create problems for any solid waste management system because of both its volume and characteristics.

b. Onshore

The most prevalent problem resulting from sanitary landfill is leaching. This results because the water table in the South Atlantic coastal states is high. Groundwater or infiltrating surface water moving through the solid waste can produce leachate, a solution containing dissolved and finely suspended solid matter and microbial waste products. This can in turn effect the quality of nearby surface water and ground water. Another problem is the production of decomposition gases such as methane, carbon dioxide and sometimes sulfate which can cause contamination of aquifers.

Impacts on existing solid waste management systems as a result of the proposed sale are predicated on expected population changes and on a figure of six pounds/person/day (1.1 ton/person/year). This figure accounts for the various types of waste generated either directly or indirectly by each individual including residential, commercial, industrial, agricultural and so on. As has been shown in the discussion of population, region wide population increases of less than 0.1% are expected as a result of the proposed action. Since this is a low percent of increase, the solid waste that would be generated would be negligible.

F. Summary of Matrix Analysis

Table F-1 presents a recapitulation of the matrix analysis (see Appendix J) listing the potential impact (possibility of an impact) of offshore structures and oil spills based on the sensitivity scales and, in the case of oil spills, weathering as it applies to potential impact upon the nine selected resources and activities.

Table F-2 presents a summary of Table F-1 listing the number of tracts, the degree of potential impact and types of impact on the nine selected resources and activities. In summary Table F-2 indicates that two resources and one activity may receive maximal potential impacts from offshore oil and gas development.

(1) For hard (live) bottom systems: Offshore structures will have a maximal potential impact for each proposed lease tract in which this bottom type may occur. Oil spills will have a maximal potential impact on five tracts (94,104,131,132 and 244).

(2) For other benthic systems: Oil spills will have a maximal potential impact on five tracts (94,104,131,132 and 144).

(3) For sport and commercial fishing: Offshore structures will have a maximal potential impact on 17 tracts (94-96, 104-107, 119-121, 131, 132, 144, 163, 164 and 171).

Table F-1. Recapitulation of the Matrix Analysis Tables

a. Potential Impact [1/] on Littoral Systems

(1) Offshore structures will not have an adverse impact on littoral systems.

(2) Oil spills will have a minimal potential impact on littoral systems.

b. Potential Impact on Hard (Live) Bottom Systems

(1) Offshore structures will have a maximal potential impact on hard (live) bottom systems for each proposed lease tract in which hard (live) bottom systems may occur.

(2) Oil spills:

Sensitivity Rating	Tract Number	Potential Impact	Total Tracts
3	94,104,131,132 and 144	Maximal	5
2	2,57-63,65,66,86,93,95,96, 98-100,102,105-110,114-117, 119-123,127-130,139-141,145, 159,160,163-168 and 171-173.	Moderate	52
1	1,3-56,64,67-85,87-92,97,101, 103,111-113,118,124-126,133-138, 142,143,146-158,161,162,169,170, 174-225	Minimal	168

c. Potential Impact on Other Benthic Systems

(1) Offshore structures will not have an adverse impact on other benthic systems.

(2) Oil spills:

Sensitivity Rating	Tract Number	Potential Impact	Total Tracts
3	94,104,131,132 and 144	Maximal	5
2	2,57-63,65,66,86,93,95,96,98-100, 102,105-110,114-117,119-123,127-130, 139-141,145,159,160,163-168 & 171-173	Moderate	52
1	1,3-56,64,67-85,87-92,97,101,103, 111-113,118,124-126,133-138,142,143, 146-158,161,162,169,170,174-225	Minimal	168

1/ Potential impact as used in this context, expresses the possibility of an event occurring. Maximal, moderate and minimal expresses the degree of the event.

Table F-1 (continued)

d. Potential Impacts on Endangered Species

(1) Offshore structures will not have a potential impact on endangered species.

(2) Oil spills will have a minimal potential impact on endangered species.

e. Potential Impacts on Sport and Commercial Fishing

(1) Offshore structures:

Sensitivity Rating	Tract Number	Potential Impact	Total Tracts
3	94-96,104-107,119-121,131,132,144, 145,163,164 and 171	Maximal	17
2	1-24,26-28,34-36,42-44,52-55,57-68, 70-72,75,77,79-90,93,97-100,102,103, 108-110,114-118,122,123,127-130, 133-136,139-143,146-148,150-162,165-170,172,182,184-186,189-191,196-198, 206-209 and 213-215	Moderate	145
1	25,29-33,37-41,45-51,56,69,73,74,76, 78,91,92,101,111-113,124-126,137,138, 149,183,187,188,192-195,199-205,210-212 and 216-225.	Minimal	63

(2) Oil spills:

Sensitivity Rating	Tract Number	Potential Impact	Total Tracts
3	94,104,131,132 and 144	Maximal	5
2	2,57-63,65,66,86,93,95,96,98-100, 102,105-110,114-117,119-123,127-130,139-141,145,159,160,163-168 and 171-173	Moderate	52
1	1,3-56,64,67-85,87-92,97,101,103, 111-113,118,124-126,133-138,142, 143,146-158,161,162,169,170 and 174-225	Minimal	168

Table F-1 (continued)

f. Potential Impact on Shipping

(1) Offshore structures will have a minimal potential impact on shipping for each proposed lease tract. Because, at present there are no established shipping lanes, fairways or anchorage areas in the proposed leased sale area.

(2) Oil spills will have no potential impact on shipping.

g. Potential Impact on Aesthetics

(1) Offshore structures will have a minimal potential impact on aesthetics for each proposed lease tract, because the structures will not be visible from shore.

(2) Oil spills will have a minimal potential impact on aesthetics for each proposed lease tract. Because the distance to the nearest coastline (48 km) should allow time for hydrocarbon degradation and clean-up efforts to function.

h. Potential Impact on Outdoor Recreation

(1) Offshore structures will have no potential adverse impact on outdoor recreation.

(2) Oil spills will have a minimal potential impact on outdoor recreation for each proposed lease tract (see g.2.).

i. Potential Impact on Cultural Resources

(1) Offshore structures will have no potential impact on cultural resources.

(2) Oil spills will have a minimal potential impact on cultural resources for each proposed leased tract (see g.2.).

Table F-2. Summary of Potential Impacts on Selected Resources and Activities from Offshore Structures and/or Oil Spills

Selected Resources and Activities	Number of Tracts					
	Maximal Potential Impact 1/		Moderate Potential Impact		Minimal Potential Impact	
	Offshore Struct.	Oil Spills	Offshore Struct.	Oil Spills	Offshore Struct.	Oil Spills
Littoral Systems	NA 2/	0	NA	11	NA	214
Hard (Live) Bottom Systems	215	5	0	52	0	168
Other Benthic Systems	NA	5	NA	52	NA	168
Endangered Species	NA	0	NA	11	NA	214
Sport & Commercial Fishing	17	5	145	52	63	168
Shipping	0	NA	0	NA	215	NA
Aesthetics	0	0	0	0	215	215
Outdoor Recreation	NA	0	NA	0	NA	215
Cultural Resources	NA	0	NA	0	NA	215

1/ Maximal - expresses the degree of an event and potential - expresses the possibility of an event to occur.

2/ NA - Not Applicable

Section 4

Mitigating Measures Included in the Proposed Action

The following measures will mitigate some of the possible adverse impacts resulting from this proposal. These measures are presented as they relate to the jurisdiction of Federal and State agencies as to oil spills, offshore structures and pipelines, and other impact-producing activities associated with this proposal.

A. Federal Regulations and Enforcement

Although many Federal agencies have responsibilities in energy and environmental affairs policy of the United States, only certain ones have direct OCS regulatory and enforcement authority. These include the Bureau of Land Management, U.S. Geological Survey, Federal Aviation Administration, Materials Transportation Bureau, U.S. Coast Guard, Federal Power Commission, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency and U.S. Navy. Following is a discussion of the mitigating measures that are applied by these Federal agencies to OCS operations.

The Secretary of the Interior's Secretarial Order No. 2974 (revised January 19, 1977) (hereinafter known as S.O. 2974) spells out the interrelationships and the coordination required among the four Interior agencies involved in the OCS minerals program: The Bureau of Land Management (BLM), the U.S. Geological Survey (USGS), the U.S. Fish and Wildlife Service (FWS), and the National Park Service (NPS). It addresses three specific situations where coordination is required, it sets up committees at both the Washington and the field levels to carry out its provisions, and it provides for a means of resolving disagreements that cannot otherwise be resolved. S.O. 2974 is published in its entirety as Appendix E; its main provisions are briefly summarized below.

The three specific situations are: (1) Environmental Research and Monitoring calls for BLM to consult closely with FWS in designing, funding, and managing such studies; and it also provides that FWS may directly participate in these studies. It should be noted that FWS routinely consults with the National Marine Fisheries Service (NMFS; of the Department of Commerce) on matters concerning commercial fisheries on the OCS. (2) Cultural Resources Assessment Studies calls for BLM to consult closely with NPS (and others, if necessary or advisable) in designing, funding, and managing such studies. (3) OCS Operational Activities is more complex than the above two but basically it provides: (a) for BLM to request resource reports from FWS whenever an OCS area is being considered for leasing, as well as the views of FWS regarding the potential effects of oil and gas development on biotic and other resources. (b) for BLM to obtain the advice and participation of FWS, NPS, and USGS when writing lease stipulations designed to protect biological or cultural resources. (c) for FWS to participate in the alignment of pipelines. (d) for USGS to consult with and receive recommendations from BLM, FWS, and NPS regarding OCS orders, structures on the OCS, and plans for exploration or development. (e) for BLM, with the participation of FWS and USGS, to design any required biological sampling or monitoring plans, and (f) for BLM and USGS to provide NPS with any information they may have regarding the existence of cultural resources on the OCS.

Disagreements are handled through channels to the Assistant Secretary for Program Development and Budget.

1. Department of the Interior

a. Bureau of Land Management

The Bureau of Land Management develops stipulations designed to protect biological and cultural resources of the OCS as described above. The stipulations developed for proposed Sale 43 are found in Section VIII.D.6. It should be noted that BLM consults with the affected states as well as with other Federal agencies in writing lease stipulations. If these proposed stipulations are approved by the Secretary, they will be legally binding on all leases issued as a result of this proposed sale if it is held.

BLM staff at the field level review operators' actions and reports for compliance with these stipulations. In addition, the BLM environmental studies program will provide information which may be used to prepare Notices to Lessees or changes in the U.S. South Atlantic Operating Orders issued by the U.S. Geological Survey over the life of a lease. For example data collected in the Flower Garden Reef area offshore Texas were used for developing restrictions in certain operating practices.

The Bureau of Land Management administers regulations governing the granting of rights-of-way for pipelines on the OCS (43 CFR, Subpart 2883). As part of this role, BLM may propose

management studies (if pipelines are required) in an attempt to determine the most technically and environmentally sound pipeline routings to shore. Pipeline permitting will be carefully coordinated with the affected states since they will in large measure determine where pipeline, if any should be required, will come ashore (see Section I.E.2.).

B. U.S. GEOLOGICAL SURVEY

Regulations governing lease operations on the OCS are administered by the U.S. Geological Survey. These regulations are contained in Title 30, Part 250 of the Code of Federal Regulations (CFR). These regulations will be implemented in the South Atlantic OCS by the proposed South Atlantic OCS Orders.

(1) Proposed South Atlantic OCS Operating Orders

A notice for public comment on the proposed South Atlantic OCS Orders 1, 2, 3, 4, 5, 7, and 12 was published in the *Federal Register* (41:248) on December 23, 1976 and for proposed OCS Order No. 15 on October 20, 1976 (FR 41:204). Appendix G contains the full text of these proposed OCS Orders. These eight orders (1-5, 7, 12 and 15) will be issued in a final form prior to proposed OCS Lease Sale No. 43, should it be held. Significant public comments on and explanation of changes made in the proposed Orders will be published in the *Federal Register* with the finalized Orders. Orders 6, 8, 9, 11, 13, and 14, which are associated with the post-exploration or production phase of offshore operations are still undergoing internal review and will be available for public comment in the future. OCS Order No. 10 concerns marine sulfur extraction and probably will not be issued for the South Atlantic. Additional OCS Orders may be prepared and issued and the existing Orders revised as the need occurs throughout OCS operations in the South Atlantic. In the case of non-compliance lessees are subject to the penalty provided for in the OCS Lands Act of 1953. A general description of operating requirements and the migratory aspects of the proposed South Atlantic Orders follows.

The Geological Survey has proposed to amend 30 CFR Part 250 to provide for issuance of National OCS Orders (FR 42:125; 6/29/77). This proposal and proposed National OCS Orders 1, 3, and 4 are appended to Appendix G.

Proposed South Atlantic OCS Operating Order No. 1

This Order requires all platforms, drilling rigs, drilling ships and wells to have signs of standard specifications for identification of the operator, the specific lease block of operation, and well number.

This Order also requires that all subsea objects resulting from lease operations which could present a hazard to other users of the OCS must be identified by navigational markings, of a design approved by the Supervisor and not inconsistent with applicable U.S. Coast Guard Regulations (Appendix F). Under this provision, the potential for accidents associated with subsea production systems, "stubs," fishing gear, and ship anchors is substantially reduced as is the possibility of an oil spill from such an accident.

This mitigates impacts caused by subsea completions on commercial fishing activities and anchoring, and mitigates impacts caused by the presence of platforms or drilling operations on shipping and navigation.

Proposed South Atlantic OCS Operating Order No. 2

Proposed Order No. 2 concerns procedures in drilling of wells. It requires the operators to file an application for drilling which includes information on the drilling platform or vessel, casing program, mud program, blowout prevention equipment, well control and safety training of operators' personnel, and a list of description of critical drilling operations which are or may be performed. The Order then describes certain procedures or equipment to be used in each phase of the drilling operation.

Due to the technical complexity of the proposed Order, not all details are included in describing its mitigatory impact—the reader may refer to Appendix G to review the entire Order. This proposed Order requires that all drilling platforms and vessels to be used must be capable of withstanding oceanographic and meteorological conditions of the South Atlantic; applications must include all pertinent data on the fitness of the platform or vessel and each such drilling structure must be inspected by the GS for compliance with OCS Orders. The requirement should eliminate most concerns about the impact of South Atlantic weather, waves, sediment scour, and currents on offshore structures. Operators

must collect and report oceanographic, meteorological, and performance data of the vessels and platforms during operations in order to assist in developing future or revised operational guidelines for the South Atlantic.

All wells must be cased and cemented in order to support unconsolidated sediments, prevent leakage of fluids between formations or pressure changes in the well. If there are indications of improper cementing, the well must be recemented and logs run to indicate proper sealing of the well hole walls. The casing design and setting depths are to be based on all engineering and geologic factors including the presence or absence of hydrocarbons, potential hazards, and water depths; additional casing strings may be required if abnormal geopressures are encountered in initial wells in an area of the South Atlantic. A pressure test is required of all casing strings, except the drive or structural casing, to determine the presence of leaks or inadequate cementing. The use of casing described in this Order should eliminate potential impacts of fresh water zone contamination, lost production, or the possibility of accidents caused by improper casing.

Blowout preventers and related pressure control equipment must be installed, used and tested in a manner necessary to insure positive well control. A specific number of these preventers must be used in every well and they must include a fail-safe design; dual control systems, and fail-safe valving in critical lines and outlets. These devices provide protection against oil spills resulting from blowouts.

The characteristics, use, and testing of drilling mud, and the conduct of related drilling procedures shall be such as to prevent the blowout of any well. Sufficient quantities of mud are to be maintained and readily accessible for use at all times to insure proper well control. This part of proposed Order No. 2 will provide additional protection against possible blowouts.

Representatives of the operator will provide on-the-site supervision of drilling operations on a 24-hour operation basis. A member of the drilling crew or the toolpusher will maintain surveillance of the rig floor continuously from the time drilling operations commence until the well is either completed or abandoned. All supervisory personnel including drillers must be trained in present day methods of well control, and records of the training are to be kept at the well site. Participation in weekly blowout prevention exercises are required for all rig personnel. These requirements will also substantially reduce the possibility of blowouts in all kinds of weather, and provide additional safety margins for all crew members. Procedures to be followed when drilling operations are undertaken to penetrate reservoirs known or expected to contain hydrogen sulfide gas are now included in U.S. Geological Survey OCS Standard No. 1(GSS-OCS-1), "Safety Requirements for Drilling Operations in a Hydrogen Sulfide Environment." This set of standard operating procedures will assure proper testing and safety of the crew as well as the drilling platform or vessel should H_2S be encountered. Hazards of H_2S are substantially reduced by the institution of these procedures.

Since some operations performed in drilling are more critical than others with respect to well control, fire, explosion, oil spills or other accidents, each operator must file with the Supervisor for approval a Critical Operations and Curtailment Plan for the lease.

This Order includes a list and a description of categories of critical operations which are likely to be conducted. Before exceeding the operational limits of an approved plan the operator must notify the Supervisor and curtail operations. This allows the Geological Survey to provide either specific approval in advance of the conduct of the critical operation or to dispatch personnel to the lease site for observation of the operation. This part of proposed OCS Order No. 2 will provide additional governmental control over drilling operations which may be hazardous to the drilling platform, vessel, crew, and the environment.

Proposed South Atlantic OCS Operating Order No. 3

This Order is established to provide control of plugging and abandonment of wells which have been drilled for oil and gas. For permanent abandonment of wells, cement plugs must be placed so as to extend 30 meters (100 ft) above the top and 30 m below the bottom of fresh water, oil and gas zones to prevent those fluids from escaping into other strata. Portions of a well in which abnormal pressures are encountered are also required to be isolated with cement plugs. Plugs are required at the bottom of the deepest casing where an uncased hole exists below. Plugs or cement retainers are required to be placed 30 m above the top and

30 m below any perforation interval of the well hole used for production of oil and gas. A "surface" plug 45 m (150 ft) long shall be placed 45 m or less below the ocean floor. A pressure test must be made on top of the first plug below the surface plug. The spacing between plugs must be filled with drilling muds of sufficient density to exceed the greatest formation pressure encountered in drilling the interval. The casing and piling on the sea floor must be removed to a depth below the ocean floor approved by the Supervisor. For temporary abandonments, all plugs and mud discussed above must be placed in the well with the exception of the surface plug. (The temporary abandoned well would have to be marked in accordance with proposed Order No. 1).

This Order should eliminate concern about contamination of fresh water zones or the possibility of oil and gas leaks from completed wells. The requirement that the sea floor above each final abandonment must be cleared, and that the removal depth of casing and piling must be examined on a case-by-case basis, will provide protection to navigation and fishery interest. The chance that obstructions might become exposed due to sand wave migration is reduced as well.

Proposed South Atlantic OCS Operating Order No. 4

Proposed Order No. 4 provides for extension of a lease beyond its primary term for as long as oil or gas are being produced in paying quantities. If these circumstances should occur, a lease can be extended beyond its initial term, pursuant to Section 8(b)(2) of the OCS Lands Act and Title 30 CFR 250.11 and 250.12 (d) (1).

In addition to a production test for oil, one of similar duration is required for gas. All pertinent engineering, geologic, and economic data is required to support a claim that a well is capable of being produced in commercial quantities. Each test must be witnessed by the Geological Survey, although with prior approval an operator affidavit and third party test results may be acceptable. One primary purpose of this Order is to assure that a lease has been found to be capable of producing oil or gas prior to extending the lease beyond its initial 5-year term.

Proposed South Atlantic OCS Operating Order No. 5

This Order sets forth requirements for the installation, design, testing, operation, and removal of subsurface safety devices.

Proposed Order No. 5 requires that all well tubing installations open to hydrocarbon-bearing zones shall be equipped with a surface controlled, subsurface safety device that is placed 30 m or more below the ocean floor. All wells perforated and completed but not placed on production must be equipped with a subsurface safety device or tubing plug within two days after the well is completed. Subsurface safety devices shall also be placed in injection wells unless they are incapable of flowing. All safety devices must comply with the minimum standards set forth in the "API Spec. 14A, First Edition, October 1973, Subsurface Safety Valves" and recent supplements as approved by the Area Supervisor. Testing of the device must take place monthly for six months after installation and quarterly thereafter; if if does not operate correctly, it must be promptly removed with properly operating device put in place and tested. Additional protective equipment is also required with the use of subsurface protective devices. In a case where tubing installations have been opened to hydrocarbon zones and are not equipped with subsurface safety devices (during workover), the installation must be so identified and such a device or tubing plug must be available at the field location to be emplaced if necessary. Records must be kept of all subsurface safety devices employed at each well with quarterly reports prepared on reasons for any failures of the devices.

This Order provides additional means to prevent blowouts and keep wells under control, thereby reducing risks and impacts from spills.

OCS Operating Order No. 6

This Order will pertain to the development stage of leases and although not yet released, will be available prior to the Federal and State review of development plans. Order No. 6 will set forth requirements for conducting workover operations and will require all completed wells to have casing heads, wellhead fittings, and valves which are designed for handling pressures exerted by the well. It will also require specific testing procedures for the well. Accordingly, this Order will provide for protection of the well during workover and from rupture or loss of oil and/or gas by leakage and thus greatly reduce the possibility of environmental impact from release of oil and gas.

Proposed South Atlantic OCS Operating Order No. 7

Proposed Order No. 7 concerns the prevention of pollution to the marine environment and provides rules for the disposal of waste materials generated as a result of offshore operations.

Proposed OCS Order No. 7 sets forth a means to effectively deal with pollution of the marine environment from offshore petroleum operations. It states that the operator must prevent pollution of the ocean and that the disposal of waste products must not create conditions that can "adversely affect the public health, life or property, aquatic life or wildlife, recreation, navigation or other uses of the ocean." The operator must submit a list of drilling mud constituents, additives, and concentrations expected to be used—this provides a means to prohibit or alter the disposal and use of specific components which might be harmful to the environment. Muds containing free oil shall not be disposed of into the ocean and toxic substances must be neutralized prior to disposal. These requirements greatly reduce the potential impacts on biological communities, water quality, commercial fisheries, and offshore recreation of oil and gas operations and also mitigate impacts along the coastline which would be caused by the washing of oil, fuel, or chemical residues and toxic substances onshore. Discharges from the rig must meet EPA standards—reducing impacts to marine water quality.

No cuttings, sand or other solids containing free oil are to be disposed of into the ocean unless the oil is removed, thus eliminating potential impacts to water quality and marine organisms caused by such introduction of oil to the marine environment. No solid waste materials or debris can be disposed of in the marine environment but must be incinerated or transported to shore for disposal according to governmental regulations; this requirement eliminates potential impacts to fisheries.

All personnel must be thoroughly instructed in the prevention of pollution from offshore operations. Rigorous inspection schedules are required for all facilities. Pollution reports are necessary for all oil spills with notification of proper authorities. Standby pollution control equipment must be maintained or available to each operator. The equipment must include booms, skimmers, cleanup materials, and chemical agents (though chemical agents can only be used with the express consent of the Supervisor) and it must be inspected monthly with proper maintenance. Results of inspections of this equipment must be recorded. Any application for a drilling permit must include an oil spill contingency plan with provisions for varying degrees of response effort depending on severity of oil spill; identification of containment and cleanup equipment availability; notification procedures of responsible persons and alternates in the eventuality of a spill; and provision for specific actions to be taken after discovery and notification of an oil discharge. Should a spill occur, immediate corrective action must be taken. This portion of the Order provides the maximum protection available for the prevention and cleanup of oil spills. It provides substantial reduction in the potential impact of oil spills.

OCS Operating Order No. 8

Although no draft version of this Order has been released for the South Atlantic, it will be available for State and Federal review prior to the submission of any operator development plans. Order No. 8 will provide approval procedures for the installation and operation of platforms, fixed and mobile structures, and artificial islands to be used for production of offshore oil and gas. Safety procedures and pollution control equipment requirements will also be set forth. This order will provide controls for the prevention of pollution impacts resulting from day-to-day operations, will provide protection against geological hazard impacts on operations, and help prevent impacts on biological communities, water and air quality, and on human use of the OCS.

OCS Operating Order No. 9

This Order will also be available for Federal and State review prior to submission of operator development plans. Order No. 9 will provide approval procedures for pipelines. Information to be submitted for approval will include the purpose of each line, proposed route, water depths, capacity, operating pressures, size and grade of pipe, burial depth, corrosion protection, protective coating, connecting and metering facilities, and pressure control facilities. The methods of welding and laying the pipeline will be monitored, as is the installation of connecting facilities. A hydrostatic test to greater than the designed working pressure of the line will be made upon completion of installation.

Agreements made between the Department of Transportation and the Department of the Interior provide better coordination of these agencies in development of pipeline standards, construction monitoring and inspections.

The effect of this Order will greatly reduce the chance for offshore oil spills or gas leaks. The approval of pipeline routes by the GS as well as BLM and the Department of Transportation (Section IV.A.2.b.) can effectively reduce a variety of impacts to marine and coastal biota and multiple uses of the South Atlantic OCS.

OCS Operating Order No. 11

As in the case of Orders 6, 8, and 9, Order No. 11 will be available before development plans are submitted. It will provide for the prevention of waste, conservation of oil and gas, and protection of correlative rights. Requirements for maximum efficient recovery of oil and gas from a lease and establishment of production rates for oil and gas will be presented. It will also state that each operator shall produce without waste his proper share of oil and gas from a common source of supply. Procedures to be followed in the eventuality of shutins for overproduction or storms will be set forth as will requirements for all tests of well producibility. Requirements concerning the location of all wells will be presented, as will the authority of the Supervisor to decide issues on field unitization.

Therefore, this Order will provide a means to insure a proper production of oil and gas and placement of facilities to maximize production while minimizing environmental impact.

Proposed South Atlantic OCS Order No. 12

This proposed Order sets forth requirements for public availability of data and records concerning offshore petroleum operations. Under the Order, specific types of information, data and records pertaining to production, operations, well tests, sales of lease production, accidents, inspection, and pollution incidents are to be available for public inspection. However, privileged information such as geological and geophysical information would not, at least for a period of time, be made available for public inspection.

OCS Operating Order No. 13

This Order as well as 14 and 15, has not been issued for the South Atlantic OCS. It will be issued before any development plans are submitted for review and approval. Order No. 13 will require the accurate measurement of oil and gas production and set forth conditions under which production from several wells can be commingled. Standards will also be set for meters to be used for measuring production. This Order will offset any possible attempts of fraud and alleviate public concerns that operators are under-estimating royalties due the Federal government.

OCS Operating Order No. 14

Order No. 14 will assure diligence in the development of OCS natural resources by allowing limited suspensions of operations or production while the operator is waiting for installation of equipment or granting of permits necessary for transportation of oil and gas from a lease. Criteria will be set under which suspensions can be granted and will provide a means to determine if production is being withheld for other purposes. A proposed version of this Order for the Gulf of Mexico was issued on December 19, 1975.

OCS Operating Order No. 15

Order No. 15 will detail the required data contents and the review process to be followed before the Area Supervisor can grant approval of a lease development plan(s) pursuant to the November, 1975 changes in regulation 30 CFR 250.34 (Appendix H). The lessee will submit information to the directly affected states concerning the proposed onshore and offshore facilities anticipated for development. This information may be submitted to the affected states prior to the formal submission of development plan(s) to the Supervisor.

Inspection Programs and Approval Requirements

To enforce the Geological Survey Operating Regulations (30 CFR 250) and OCS Orders, a comprehensive inspection system has been developed. OCS operators must receive approval before commencing any work. Operators are required to submit a notice and detailed description of work they desire to perform to the USGS District Supervisor. This requirement is to insure that no operation is conducted without thorough planning for safety, conservation, and protection of the environment, and to determine that all operations meet the standards established by regulations and OCS Orders.

On-Site Inspections

All operations, regardless of the activity, will receive regular on-site inspection for compliance with regulations and OCS Orders. The Geological Survey uses a systematic program including unannounced inspections to assure the achievement of safety objectives.

Floating drilling vessels or drilling units will receive a detailed inspection to insure conformance with regulations and OCS Orders before commencement of drilling operations. These predrilling inspections are comprehensive and often require several days to complete. The Eastern Region of the Geological Survey intends to inspect these rigs daily during the drilling of a well, and all well control, safety, and pollution control equipment will be inspected for proper function.

Permission to either abandon or suspend a well must be granted by the USGS; this includes the setting of all required cement plugs, the cutting of the several casing strings below the sea floor, and the removal of all subsea equipment. The depth below the sea floor at which the casing is removed will be reviewed by the USGS on a case-by-case basis to ensure that sediment migration will not eventually expose the plug (proposed South Atlantic OCS Order 3).

Well workover and well abandonment phases of OCS operations, as with drilling, will receive both scheduled and unscheduled inspections, depending on the progress of a particular operator. Drill stem testing, cement plugs set prior to redrilling a well, cement plugs set to temporarily or permanently abandon a well, and all casing cementing operations must be approved by the GS Supervisor.

OCS pipelines will be installed in accordance with proposed South Atlantic OCS Order No. 9, which will provide for submittal of information such as purpose of each line, proposed route, water depths, capacity, operating pressures, size and grade of pipe, burial depth, corrosion protection, protective coating, connecting and metering facilities, and pressure control facilities. The methods of welding and laying the pipeline are monitored, as in the installation of connecting facilities. A hydrostatic test to greater than the design working pressure of the line is made upon completion of installation.

Inspection Schedule and Enforcement

The inspection program for the South Atlantic OCS area will be maintained by the Geological Survey with the intent that required regulations will be followed to avoid potential hazards to personnel, provide protection for the environment, and preserve the multiple-use concept of the OCS lands. Warnings and operational shut-downs for incidents of non-compliance will be issued and the date of correction of defects will be recorded.

The Geological Survey anticipates that a temporary office will be established to oversee and inspect the initial industry exploratory activities in this South Atlantic area. This office would report to and be supported (technically and administratively) by the Office of the Atlantic Area Oil and Gas Supervisor for Operations in the Conservation Division of the USGS. The location of the office would be contingent upon two primary logistic considerations, i.e., proximity to the concentration of exploratory operations and to the adequate helicopter service areas. The initial staffing of the office would be expanded concurrent with the level of activities in the event the sale is held.

Visual inspections of the water surface over OCS pipelines in other operating areas are currently made by the operator for evidence of failures and leaks. GS and operator personnel in those areas visit production facilities daily and follow a route approximating the pipeline route. Although no specific inspection schedule has been established for this South Atlantic area to-date, the GS will assure that thorough and frequent inspections will be carried out in this proposed sale area. Such a schedule will be developed concurrently with the initial phases of exploration, and will continue through the life of the field.

A routine schedule for external inspection by operators of marine pipelines, for evidence of failures and leaks, including risers to the platforms, will be required for the South Atlantic OCS area.

An approved contingency plan is required from each operator in the area that will include spill control, containment and cleanup, and measures to be taken if there is any likelihood that hydrogen sulfide gas might be encountered during the drilling operation.

Inspection Procedures for Subsea Systems

Subsea systems may possibly be used to produce oil and gas resulting from this proposed sale. Inspections of these systems in the U.S. South Atlantic will be in accordance with the proposed OCS Orders. A new OCS Order especially designed for subsea systems is presently being considered. Proposed Order No. 1 requires the surface marking of all such systems in accordance with guidelines developed by the USGS Supervisor.

The many Federal agencies involved in the review process of subsea systems include in addition to the Geological Survey: EPA, Coast Guard, Corps of Engineers, U.S. Fish and Wildlife Service, and the Bureau of Land Management. Except for proprietary parts, plans for exploration and development utilization are available for general public review.

Operator Reports

A comprehensive reporting system covering all oil spills and any unusual conditions (for example, reporting and investigation of a persistent oil slick from an unknown source, such as a sunken ship or natural oil seep) is to be required by the proposed OCS Orders, and is a key factor in monitoring operations in the U.S. South Atlantic area. Operators are also required to maintain records for inspection by the Geological Survey of required periodic tests of safety equipment. A digest of these operator reports and the various forms that are required can be found in the proposed U.S. South Atlantic OCS Order No. 12 in Appendix G.

Requirements Specific to U.S. South Atlantic Operations

Specifically tailored requirements for the U.S. South Atlantic under the proposed OCS Orders are discussed below.

Proposed Order No. 1 requires all subsea structures (be they temporarily abandoned wells or subsea production systems) shall be marked on the ocean surface in accordance with guidelines developed and approved by the Supervisor and other Federal regulations. This will provide a means to reduce potential damage to fisheries gear or petroleum production equipment as a result of accidents.

Reports on all encountered oceanographic and meteorological conditions encountered by drilling structures and the performance of the structures will be required of all offshore operators in the U.S. South Atlantic OCS.

Proposed Order No. 2 specifies that casing will meet API standards. In addition, cross referenced in proposed Orders Nos. 2 and 7 is approval by the USGS of the mud program before drilling; all substances in the muds to be used must be identified and their use must comply with EPA standards under the Federal Water Pollution Control Act, as amended. No direct ocean disposal of oil-based drilling muds will be allowed in the U.S. South Atlantic, and any request for variance must be reviewed on a case-by-case basis. Although there is no indication of the potential for encountering hydrogen sulfide, safety procedures, equipment, and warning devices will be necessary on offshore drilling rigs and platforms.

As described earlier in this section, casing removal depths will be looked at individually under proposed OCS Order No. 3. To determine whether or not a lease can be extended beyond five years due to discovery of petroleum, an actual production test must be run and all economic, geologic, and engineering data must be supplied to the USGS Supervisor (proposed OCS Order No. 4).

In addition to no direct ocean disposal of oil-based drilling muds, under proposed Order No. 7, no cuttings containing oil can be disposed of at sea; instead, these cuttings must either be washed to remove the oil, with the wash water shipped ashore, or the unwashed cuttings with oil must be shipped ashore. Both methods will be dealt with by applicable State or EPA regulations. All produced formation water must be treated to meet appropriate EPA water quality standards prior to discharge at sea. Copies of all analyses done on produced formation waters must be sent to the USGS Supervisor and EPA. Oil spill containment equipment must be available to the operator; monthly inspections of this equipment will be performed by the USGS.

Under new procedures for State considerations of OCS oil and gas development plans (Federal Register, 40 (179): 42559-42560; 40 (182): 43036; and 40 (213): 51199-51200, see Appendix H), the operator must supply a description of all onshore and offshore facilities and operations which are anticipated; plus other pertinent information regarding these developments, to the Governors of directly affected States 30 days before a formal development plan is submitted to the USGS Su-

pervisor. The states will then have 60 days to review this data to determine its adequacy and comment on it. The Director of the USGS can then further delay development at the States' request until necessary information is provided to the States. In addition, a copy of development plan (minus proprietary data) is also submitted to the Governors of directly affected States at the same time the entire development plan is submitted to the USGS Supervisor. The States have 60 days to review and comment on the submitted plan. This information provided to the States can be used by State agencies to prepare for any environmental and socio-economic impacts which might result from development; they also are afforded, through the Governors, an opportunity to comment or criticize the anticipated development plans.

Enforcement

The USGS policy is intended to eliminate any noncompliance with lease requirements by the operator that may lead to loss of life, loss of property and resources, or damage to the environment. A standardized compilation of items has been prepared by the USGS, entitled "List of Potential Items of Noncompliance and Enforcement Action", the "PING" list, which is used for inspections. During an inspection of drilling and production operations, depending on the hazard presented toward safety or pollution, either a written warning will be given that allows the operator seven days to correct the incident of noncompliance (INC), or a shut-in order will be issued. The shut-in order may be applied only to the equipment affected by the incident of noncompliance (INC), such as a particular piece of production equipment or a producing zone, or to the entire drilling rig, production platform, or onshore facilities, as required.

Additional penalties for noncompliance are specified in Sec. 5(a)(2) of the Outer Continental Shelf Lands Act of 1953, 43 USC Sec. 1334(a)(2).

> Any persons who knowingly and willfully violates any rule or regulation prescribed by the Secretary for the prevention of waste, the conservation of natural resources, or the protection of correlative rights shall be deemed guilty of a misdemeanor and punishment by a fine of not more than $2,000 or by imprisonment, and each day of the violation shall be deemed a separate offense.

Also, Sections 5(b)(1) and 5(b)(2) provide for cancellation by notice of nonproducing leases subject to judicial review or appropriate judicial proceedings.

(2) Waivers of OCS Orders

A departure (waiver) from OCS Orders or other rules of the USGS Supervisor may be granted under 30 CFR 250.12(b) when such a departure is determined to be necessary for one of the following reasons:

a. The proper control of a well;
b. Conservation of natural resources;
c. Protection of aquatic life;
d. Protection of human health and safety;
e. Protection of property;
f. Protection of the environment.

(3) Notices to Lessees and Operators

Notices to Lessees and Operators are used when expeditious clarifications, corrections, or additions to the OCS Orders and regulations are necessary. By issuing Notices to Lessees and Operators, the extensive amount of time necessary to amend and republish orders and regulations is avoided.

Notices to Lessees and Operators for the South Atlantic area, which will be applicable to any leases resulting from this proposed sale, are being prepared at the present time by the Geological Survey. Interested Federal agencies, such as BLM, and the states of the South Atlantic, will be offered an opportunity to review and comment on the Notices before they are issued.

As an example, Notice No. 76-2 for the Mid-Atlantic OCS is included as Appendix N. This Notice spells out the requirements for certain surveys required of the lessee prior to his beginning any drilling activity. The Geological Survey indicates that the corresponding Notice for the South Atlantic will contain survey requirements for all surveys that may be required by the lease stipulations (see Section VIII.D.6.) as well as those surveys required by the OCS orders.

(4) Unitization of Producing Fields

The following regulations enable the Department of the Interior to require that a producing oil and/or gas field be unitized and the manner in which it is to be carried out, although no unitization requirement has been decided on as yet for this proposed sale:

30 CFR 250.50 grants the Director of the USGS authority to demand pooling or unitization which the Secretary is authorized to require under

the OCS Lands Act in the interest of conservation.

30 CFR 250.51 refers to the unit plan regulations contained in 30 CFR 226 with regard to obtaining approval of units or cooperative agreements.

30 CFR 250.52 lists purposes for which the Area Oil and Gas Supervisor of the USGS may approve pooling or drilling agreements.

Unitization has taken place in the operating areas where a field overlies adjacent tracts (usually two to four) and each tract is owned by different operators. The authority to unitize may be utilized for purposes of conservation, controlling withdrawals of oil and gas from the field, more efficient production, and reservoirs pressure maintenance during initial stages of operation.

(5) *Geophysical Information Concerning Geological Hazards*

Knowledge of near-surface structural conditions is fundamental to a sound lease management program for the OCS. Geophysical data which show the shallow structural and sedimentary environment are used to predict, and thus minimize, any geological hazards to drilling operations and consequent possible dangers to the environment from pollution. Surface and shallow subsurface geological hazards, when properly identified and correlated with surrounding strata, seldom create insurmountable obstacles to a minimal risk program of exploration and exploitation of economically attractive structures.

High resolution geophysical data covering all tracts to be offered for this proposed sale are presently being analyzed by geophysicists and geologists of the USGS Conservation Division. These data, in the area of coverage, provide definitive information on thickness of the unconsolidated sediment, structural configuration on shallow seismic horizons, sea floor anomalies, slumps, shallow subsurface faults, unstable bottoms, near-surface gas pockets, and buried subsurface channels. Preliminary analyses have already been conducted on high resolution geophysical records collected by the USGS Geologic Division in Woods Hole as part of the BLM environmental studies program; the records are also being examined by personnel of the USGS Conservation Division, Eastern Region Office (Washington, D.C.).

Interpretations of high resolution sub-bottom profile data made by potential lessees that will disclose bottom sub-surface conditions posing special environmental hazards for drilling or producing operations in the U.S. South Atlantic offshore area, will be made available to the Bureau of Land Management prior to the decision to issue a lease, and to the Geological Survey prior to the approval of legislative drilling operations.

2. Department of Transportation

a. FEDERAL AVIATION ADMINISTRATION

The Federal Aviation Administration is responsible for the monitoring and control of aircraft flights, training of operators, and certification of general operations (Federal Aviation Act of 1958). Flight plans must be filed for all flights which take place in defense warning zones over the OCS (General Operations and Flight Rules, Part 91. Subpart B; Part 121, Subpart U; Part 135, Supplemental Rules). Individual flights through the defense operating areas must be cleared with the Commander, Eastern Sea Frontier (U.S. Navy). The FAA office in charge of certifying of operators, training programs, and aircraft will depend on where the operator is based in the U.S. South Atlantic and the size of the aircraft that will be used.

b. MATERIALS TRANSPORTATION BUREAU

The Office of Pipeline Safety Operations within the Materials Transportation Bureau supervises safety of gas and oil pipelines including the establishment of design criteria for pipeline systems on the OCS. The Department of Transportation is authorized under the Natural Gas Pipeline Safety Act of 1968 (49 U.S.C. Secs. 1671, et seq.) to establish gas pipeline safety standards for transportation of gas and for pipeline facilities. Gathering, transmission or distribution by pipeline or storage in or affecting interstate or foreign commerce is included in the meaning of transportation of gas. The Secretary of Transportation is authorized to advise, assist and cooperate with other federal departments in the planning and development of the standards and in methods for inspecting and testing to determine compliance with the standards. Regulations implementing the Department's authority for gas and oil pipelines are found in 49 CFR Parts 192 and 195. Recent regulations by the MTB more clearly delineate criteria for safety standards for offshore liquid pipelines (including burial depths), (41

Federal Register 34035), and for offshore natural and other gas pipelines (41 Federal Register 34598). New regulations were also issued in 1975 (Federal Register 40, No. 91, May 9, 1975) requiring odorizating of gas transmission lines by class location (class determined by population in the area).

c. U.S. COAST GUARD

The OCS Lands Act delegates to the Coast Guard the authority to promulgate and enforce regulations covering warning devices, safety equipment, and other matters related to the promotion of safety of life and property on fixed OCS platforms and drilling vessels. The implementing regulations for this delegation are contained in Title 33 of the Code of Federal Regulations, Part 67 and Subchapter N, Parts 140 to 147. Other Coast Guard regulations cover safety equipment on all types of offshore facilities and vessels, specific personnel licensing procedures, and minimum levels for ships and boats, and prohibit the discharge of pollutants from all vessels.

Lead Coast Guard responsibility resulting from this proposed lease sale will be undertaken by the Seventh Coast Guard District (Miami) since all of the proposed lease tracts are contained in their jurisdiction. Certification of vessels (both boats and rigs) will depend on most recent certification date and operations port. The Coast Guard's responsibility as to oil spill containment and cleanup is discussed under the heading "Contingency Plans" later in this section.

A Memorandum of Understanding between the U.S. Geological Survey and the U.S. Coast Guard is also discussed. No Coast Guard surveillance program for oil spills emanating from rigs, platforms, or pipelines have been developed yet for this U.S. South Atlantic although oil pollution and law enforcement patrols by Coast Guard aircraft cover part of this area. It can be expected that with OCS development and the recent enactment of a 200-mile limit fisheries management law, patrols will be expanded (U.S. Coast Guard, Written Testimony, Public Hearings, DES for Proposed OCS Lease Sale No. 40, 1976, Mid Atlantic).

As standard procedure, the Army Corps of Engineers will request comments from the Coast Guard on the placement of offshore rigs and platforms with respect to interference with navigation. Though no specific regulations are in force, the Corps of Engineers generally does not allow structures to be placed within traffic lanes as identified by the Coast Guard.

3. Federal Power Commission

The Federal Power Commission (FPC) has responsibility under the Natural Gas Act to safeguard public convenience and necessity by the certification of proposed interstate natural gas facilities, regulation of interstate gas prices, and authorization of interstate gas purchases and sales. In evaluating a certificate application for proposed jurisdictional facilities, an environmental impact statement is prepared for all projects where FPC approval would constitute a major Federal action significantly affecting the quality of the human environment. All natural gas produced from the OCS is considered to be interstate; therefore, all OCS gas transportation facilities excluding production and gathering facilities, are subject to FPC jurisdiction. In analyzing such offshore projects, the FPC consults with the Office of Pipeline Safety, the U.S. Coast Guard, the U.S. Army Corps of Engineers, and other Federal, state, and local authorities.

4. United States Army Corps of Engineers

The OCS Lands Act provides that the authority of the Secretary of the Army to prevent obstruction to navigation in the navigable waters of the United States be extended to structures located in the OCS. The Corps of Engineers implements this delegated authority by issuing navigational permits for exploration drilling vessels and fixed and mobile platforms according to 33 CFR 209.120 as amended by the July 25, 1975 Federal Register, pages 31320 et seq. In the event this proposed sale is held permits will be processed by the South Atlantic Engineering Division, Atlanta, Ga. In evaluating the permit application, Corps of Engineers officials will consider the following policies (from 33 CFR 209.120):

> Artificial islands and fixed structures located on the outer continental shelf are subject to the standard permit procedures of this regulation. Where the islands or structures are to be constructed on lands which are under mineral lease from the Bureau of Land Management, Department of the Interior, that agency, in cooperation with other Federal agencies, fully evaluates the potential effect of the leasing program on the total environment. Accordingly, the decision whether to issue a permit on lands which are

under mineral lease from the Department of the Interior will be limited to an evaluation of the impact of the proposed work on navigation and national security. The public notice will so identify the criteria.

5. U.S. Environmental Protection Agency

Produced waste water is an unavoidable consequence of producing oil and gas. Presently the Environmenal Protection Agency, the Geological Survey, and offshore operators in other OCS operating areas are in the process of determining the best method from an environmental protection standpoint of treating and disposing of produced waste water. The Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-550; 86 Stat. 816, hereinafter the Act), makes the discharge of any pollutant by any person, except in compliance with certain sections of the Act, unlawful. A National Pollutant Discharge Elimination System (hereinafter NPDES) was created by Section 402, and made applicable to discharges into the territorial sea, the waters of the contiguous zone, and the oceans. Permits for discharges will be issued by the Administrator (Environmental Protection Agency) in compliance with guidelines promulgated by him. While the NPDES appears to apply to fixed platforms and structures, it does not apply to 1) addition of any pollutant to the waters of the contiguous zone or the ocean from any vessel or floating craft, or 2) water, gas, or other material which is injected into a well to facilitate production of oil or gas, or water derived in association with oil or gas production and disposed of in a well. Regulations governing the NPDES may be found in 40 CFR, Part 125, 38 Federal Register 13528 (1973), and the guidelines issued pursuant to Section 403(c) of the act are found in 40 CFR, Part 227; 38 Federal Register 12872 (1973); 40 CFR, Part 435; 40 Federal Register 42572 and 42543 (1975). Subsurface injection into OCS platform wells is in accordance with Environmental Protection Agency suggested guidelines and is subject to Geological Survey approval and regulation.

The EPA office involved as a result of this proposed sale would be Region IV (Atlanta). No regular program for analysis of platform or rig discharges has been developed for the U.S. South Atlantic to date.

6. United States Navy

Although not involved in OCS petroleum operations and regulation, the Commander, Eastern Sea Frontier (New York, New York) controls military air and sea operations in the area. Because access to air space over much of the U.S. South Atlantic OCS is restricted due to reasons of national defense (and for reasons of safety), helicopter and aircraft operations in support of petroleum activities must be certified by the Commander in order to take place in certain corridors.

B. Oil Spill Containment and Cleanup

At this time, the only Federal regulations applying to oil spill prevention, containment and cleanup between the 12-mile contiguous zone and the 200-mile economic zone, within which BLM is proposing tracts for oil and gas development, are stipulations attached as a condition of leases, and OCS Operating Order No. 7. That Order is discussed below in subsection C.5. Federal pollution plans which would apply within the 12-mile limit are described below. If jurisdiction were to be extended beyond 12 miles, it is assumed that the current Federal pollution plans would be similarly applied beyond the 12-mile limit.

1. National Oil and Hazardous Substances Pollution Contingency Plan

The National Contingency Plan developed in accordance with the Federal Water Pollution Act as amended, P.L. 92-500, provides a pattern for coordinated and integrated responses by Federal agencies to oil spills and promotes the coordination of Federal and state response systems. The National Plan sets up a system for the development of regional plans and includes the resultant regional plans. Primary operational responsibilities are divided between the Coast Guard and EPA. The Coast Guard has responsibility for spills in coastal waters as defined in each regional Oil Pollution Contingency Plan. EPA has responsibility for inland waters.

Within each region, the Coast Guard has designated an On-Scene Coordinator (OSC). Additionally, Regional Response Team (RRT's) have been set up. The RRT is activated in the event of a major spill and serves as a technical advisory board to the local OSC. In the event of a spill, the OSC makes a determination as to whether or not the responsible party is able and willing to adequately combat the spill. Affected States are

invited to participate in the deliberation. In the event that the responsible party is deemed to be taking adequate corrective action, the OSC maintains a coordinating function. If it is determined that an adequate response cannot or will not be made by the responsible party, the OSC becomes an On-Scene Commander and cleanup activities are then taken over by the U.S. Coast Guard or the EPA for inland waters. Each of these agencies maintains Regional Response Centers where equipment and/or communications are located. In addition, the Coast Guard maintains a strike force on each coast which handles major spills and harbors most major cleanup equipment.

The U.S. South Atlantic proposed sale area is located within the jurisdiction of the Southeast Region Oil Spill Contingency Plan administered by the Region IV EPA Headquarters in Atlanta, Ga. Included are North Carolina, South Carolina, Georgia, and Florida. Although the Regional Response Center is Atlanta, Ga., the organization is broken down into additional subregions consisting of individual states.

Two Coast Guard Districts have responsibility for the proposed South Atlantic Sale Area. District 5 with a Regional Response Center at Portsmouth, Virginia, covers North Carolina. District 7 with a Regional Response Center at Miami, Florida, covers South Carolina, Georgia, and Florida. Coast Guard Captains of the Port located at Miami, Jacksonville, Savannah, Charleston, and Wilmington respond to all reported pollution incidents and if necessary, request assistance from the Gulf Strike Team of the Coast Guard based at Bay St. Louis, Mississippi or the Atlantic Strike Team located at Elizabeth City, North Carolina. If necessary, the Coast Guard Strike Teams are capable of providing equipment and personnel resources. The Coast Guard Districts do not rely primarily on the National Strike Force for pollution response equipment, but use primarily contractor, oil spill cooperative and local Coast Guard equipment to respond to most spills. National Strike Force equipment is used to supplement locally available equipment when required. Equipment available to Captains of the Port through the Gulf and Atlantic Strike Teams are listed in Tables B-1 and B-2.

Use of dispersants for oil spills is also regulated under the national and regional plans. Data on dispersants which might be used must be provided to EPA which can then advise OSC's regarding their use. Use of dispersants in Regions II and III in inland waters is considered only in extreme fire hazard conditions, particularly when considering use directly onto water bodies. The Coast Guard Districts discourage and/or prohibit the use of chemical dispersants. Use of dispersants under the plan is, in all cases, at the discretion of the OSC's who must consider hazards to human life, toxic effects on other organisms, as well as effectiveness of other methods before approving their use.

2. State Programs

Several of the U.S. South Atlantic states are updating their contingency plans and considering new legislation, more stringent requirements for oil handling facilities, increased or broadened liability, and more sophisticated and integrated spill response equipment and mechanisms which may be in existence in the near future. Information concerning proposed legislation or requirements is unavailable at this time although it is understood that such changes have been proposed in some states. At this time there is a general reliance on the Federal and private sectors, with states most active in enforcement activities.

3. Existing and Proposed Oil Spill and Containment Capabilities in the Region

A group of 15 companies has formed a cooperative, Clean Atlantic Associates, to provide oil spill containment and cleanup equipment for the U.S. South Atlantic OCS region. O. J. Shirley, Chairman of Clean Atlantic Associates (CAA), indicated, in the public hearings for proposed OCS Sale 43 in Savannah, GA., that "although at this time the selection of operational bases for the South Atlantic has not been finalized, they will be located at either an onshore or offshore site so that CAA members can respond promptly to any oil spill emergency that may result from our OCS activities".

The cooperative has established a base of operations for the Mid-Atlantic OCS Leasing area at Davisville, RI. CAA has contracted with Halliburton Services Company to stockpile and maintain equipment in the three Atlantic leasing areas. In the event of an oil spill incident Halliburton will coordinate spill response. The USGS has notified CAA that this action will satisfy the requirements of OCS Order 7, paragraph 3(a).

Table B-3 lists equipment available in the Mid-Atlantic operating area. CAA has authorized $1

Table B-1. Gulf Strike Team
Pollution Response Equipment

1. Air Deliverable Anti-Pollution Transfer System (ADAPTS) - 4 Type II Systems
2. ADC - (2) with 612' HSOCS Boom
3. Coastal Oil Boom - 1000', 24"
4. JBF Oil Skimmer - (1) with trailer and crane
5. Oil Mop Machine - (1) with 600' of 4" rope mop
6. SEAVAC Skimmer System - (1) conplete system
7. Mobile Command Post (32' Motor Home) - (1) with mobile telephones, Triton radio, portable telecopier, videotape recorder, fixed telephones, GKW generator, etc.
8. Boats - (1) 17' Monark, (2) 14' Zodiak boats with outboard motors
9. Scott Air Packs - (2)
10. Other Equipment - trailers, 20 ton crane, diving equipment, welders, tools, etc.

Table B-2. Atlantic Strike Team
Pollution Response Equipment

1. Air Deliverable Anti-Pollution Transfer System (ADAPTS) - 3 ADAPTS I systems and 2 ADAPTS II systems
2. High Seas Containment Barrier - 4284 feet
3. Lockheed Disc-Drum Recovery System - 1000 GPM capacity, tow vessel and holding/separating barge required
4. Mobile Command Post (31' Motor Home) - Small spill response systems 125 GPM capacity, (2) slurp skimmers, (2) Coast Guard designed skimmer heads
5. JBF Oil Skimmer - (1) with trailer
6. Commercial Boom - 400', 36" Keptner Sea Curtain
7. Modular (Pontoon) Barge
8. Boston Whalers and Utility Boats - (4), 13' to 21'
9. Assault Boats (18') - (3)
10. Other Equipment - inflatable rubber boats, outboard motors, welders, compressors, generators, diving and salvage equipment, trailers, tools, etc.

TABLE B-3 CLEAN ATLANTIC ASSOCIATES
EQUIPMENT LIST - Davisville, R.I.

	Equipment Item	Description	Quantity
1.	Fast Response Unit, Model I	Skimmer, Bay & Open Sea: The skimmer and oil storage skids attach to or are placed on workboats ranging from 70'-200' size. The skimmer is a weir type. Storage is 360 bbls.	2
2.	Fast Response Unit, Model II	Skimmer, Bay & Open Sea: Similar to above except can be transported by truck as a nonpermit load. Storage is 180 bbls.	2*
3.	Open Sea Boom - 1000'	For the purpose of containing or restricting movement of spilled oil in open seas. Manufactured by Kepner.	1
4.	Open Sea Boom - 1000'	Similar to above. Manufactured by Goodyear.	1
5.	Rapid Deployment Boom - 1500'	For purpose of containing or restricting movement of spilled oil; smaller in size than the "Open Sea Boom". Manufactured by Kepner.	1
6.	Helicopter Spray Unit	Primarily for the purpose of spraying collectant. Capacity is 150 gal.; system attaches to helicopter. Ten drums of collectant at base. Manufactured by Simplex.	2
7.	Boat Spray Unit	Primarily for the purpose of spraying dispersant. Capable of covering one acre/min. System attaches to a workboat. Fifty drums of dispersant in stock at base. Built by Halliburton.	3
8.	Bird Scarers (Set of 12)	Makes periodic "Bang" noise to scare birds away from spilled oil; for land use only - Propane Gun.	2
9.	Radio System	Provide on scene and logistical communications network for coordination of oil spill cleanup operations.	1

million in expenditures for Halliburton to buy equipment for the South Atlantic area, if this sale is held. The equipment will be similar if not identical to that located at Davisville, RI. It is planned that this base will maintain 24-hour readiness, and be able to respond within 12 hours to a spill as far as 201 km (125 miles) from its shore base, under normal conditions.

4. Status of Oil Spill Containment and Cleanup Technology

When oil is spilled on water, the first priority is to contain it or, in a river, direct it to a collection point and remove it by absorption, adsorption, or skimming. Presently available equipment is adequate for calm or enclosed waters but fails in rough seas conditions in excess of one knot currents and several foot waves (Boesch, et al. 1974).

Booms are used for containment and various types are available. They normally fail when the accumulated oil behind the barrier is carried underneath it by the current. Most often booms available break apart in high sea states and are not easily deployable in rough weather. The Coast Guard has developed a High Seas Containment Barrier that is capable of withstanding 6m (20 ft) waves and 13 km/hr (7 knot) currents (Boesch, et al., 1974), and of operating well in 1.2-1.8 m (4-6 ft) waves, 3.7 km/hr (2 kt) currents, and 37 km/hr (20 kt) winds (Atlantic Strike Team, 1974). It can be transported by plane or truck and deployed fairly rapidly. Exxon has developed a boom that has been shown capable of surviving in 6 m (20 ft) waves, 3.7 km/hr (2 kt) currents, and 37 km/hr (20 kt) winds (CEQ, 1974b). However, the boom is cumbersome and not easily deployed. To date, the best boom performance that has been reported (Exxon) is containment in 1.8-2 m (6-8 ft) seas with 32 km/hr (20-mile) winds and 2 km/hr (1.25 kt) currents. Improvements are being made but the effectiveness of booms is reaching its upper limit (CEQ, 1974b).

After containment, the oil must be collected. Straw is rapidly being replaced by mechanical skimmers and synthetic sorbents in this task. Skimmers operate on various principles and some types are now available that work well in 1.8-2 m (6-8 ft) waves, 5.5 km/hr (kt) currents, and 74 km/hr (40 kt) winds (Atlantic Strike Team, 1974), however, these latter types operate at low recovery rates (1 to 5 bbls/min). The Coast Guard is developing a combination boom and skimmer system, but this will not be available for some time. Recovered oil can then be transferred to a refinery for recycling.

When the oil slick becomes too thin to be collected by these devices absorbents and adsorbents like straw or the newer synthetic materials can be used. The synthetic sorbents include polyurethane foam, alkylstyrene beads and other coleophilic products. These absorb or adsorb 5-30 times their weight in oil, and some can be wrung out and reused. The problem with sorbents is that they themselves must be collected either mechanically or manually to prevent them from contaminating the environment.

Various chemicals may also be used to assist in collecting, dispersing, or removing the oil. Surface tension modifers and collecting agents prevent or restrict the spreading of oil on the water's surface and "thicken" the oil slick for easier collection by the skimmers and mops. Their use is authorized when it will result in the least overall damage to the environment or interference with designated water uses. Dispersants can be used to form oil-in-water emulsions that facilitates the dispersal of oil into the water column. As previously indicated, the use of these chemicals is limited, however, because of their potentially toxic effects on marine organisms. Biological agents that encourage biodegradation of the oil may also be used if previously approved. Burning agents that improve the combustibility of oil may be applied if they have been approved by EPA, and if their use will reduce imminent danger to life, limb, or property and will result in the least environmental harm when compared to other methods. The use of sinking agents is not allowed on the navigable waters of the United States.

All of the above methods are effective in calm harbor and nearshore waters but face severe limitations on the open seas, not the least of which are the 12 or more hours required to respond to a spill several miles offshore as might be the case in this proposed sale area. Oil spill containment on the open seas, then, is severely limited. However, because of the effectiveness or efficiency of recovery for any particular spill depends on a combination of wind and wave conditions, and other physical parameters, no estimate can be made of what percentage of a spill could be recovered or what amount could be recovered.

Toxicity studies involving the various chemicals available for use for collecting, dispersing, and removing of oil are, by requirement, available through EPA.

5. OCS Operating Orders

Proposed OCS Operating Order 7 for the U.S. South Atlantic (Appendix G) requires that, prior to the initiation of operations, the lessee must prepare and have approved by the Area Supervisor, Geological Survey, an Oil Spill Contingency Plan. In order to implement the plan, the lessee must maintain or have available to him, the pollution control equipment and materials necessary to effectuate containment and cleanup. The equipment must be the most effective available, given the current state of oil pollution containment and cleanup technology. A memorandum of understanding between the Departments of the Interior and Transportation outlines the respective responsibilities of the Geological Survey (GS) and the Coast Guard (CG), regarding the supervision of abatement, containment, and cleanup efforts required by the proposed Orders. Essentially, the GS is responsible for the coordination and direction of measures to abate the source of pollution, whereas the CG is responsible for containment and removal operations, as further detailed previously.

C. Mitigations Included for Specific Aspects of the Proposed Action

1. Offshore Structures and Pipelines

Currently, there are no established commercial shipping fairways in the U.S. South Atlantic OCS region (USDT-CG, 1976). Therefore, none of the proposed lease tracts would impinge on commercial shipping fairways.

The Corps of Engineers and U.S. Coast Guard have regulations pertaining to obstructions to navigation in the navigable waters of the United States. The Corps of Engineers issues navigational permits for offshore structures and the U.S. Coast Guard has requirements for audio-visual warning devices to be installed on these structures (Appendix F). These regulations would function to mitigate potential impacts between sea traffic and offshore structures.

The U.S. Geological Survey Oil and Gas Supervisor must consider the views of commercial fishing organizations and fishermen with regard to placement of platforms. The Supervisor must also coordinate with the Department of Commerce, Fish and Wildlife Service (FWS) and the Bureau of Land Management (BLM), in the decision-making process of approving or disapproving platform installation. Recent changes in 30 CFR 250.34 (Section IV.A.1.b). require that the development plan, minus proprietary data, be submitted in advance to Governors of adjacent states. Under that arrangement, states have an opportunity to comment on platform placement.

Platforms are designed for removal after their operational life. Following the depletion of all producing zones developed from a platform, wells will be plugged and abandoned. Drilling and production equipment dismantled and removed, the deck units removed, well conductors and platform piling will be cut below the mudline and removed, and the site restored in accordance with permit requirements.

Proposed OCS Order No. 7 and Environmental Protection Agency (EPA) regulations prohibit the disposal of solid waste offshore from operations which might result from this proposed sale.

As mentioned previously, should producible quantities of oil and/or gas be discovered the BLM will conduct pipeline corridor management studies in an effort to determine the most technically and environmentally practical route(s).

At present, the cooperative effort between the Department of the Interior, Corps of Engineers, National Marine Fisheries Service (NMFS) and State conservation agencies is responsible for minimizing the impact of pipeline (and other) construction in navigable waters of the U.S. in the following manner. The Corps of Engineers, through authority of the Rivers and Harbors Act of 1899 (33 U.S.C. 403), asserts authority over, and requires a permit for, construction in all navigable waters subject to the Submerged Lands Act (43 U.S.C. Sec. 1301) and includes all lands permanently or periodically covered by tidal waters up to the line of mean high tide.

The EPA reviews and comments on dredging projects in navigable waters in accordance with a memorandum of understanding with the Corps of Engineers dated July 13, 1967.

The Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) (through NMFS) has been vested with responsibility for participation in matters relating to marine and estuarine areas. The FWS, NMFS, EPA and appropriate State agencies, now review

all applications to the Corps of Engineers for permits to construct pipelines in navigable waters and assess their potential impact on fish and wildlife resources and the environment. Especially sensitive areas such as any area of special biological significance, bay, or estuary occupied by rare or endangered species would be examined very critically. When appropriate, these agencies recommend to the Corps specific modifications of project plans which are needed to reduce impact on these resources.

In addition to the above effects to mitigate potential impacts associated with pipeline, the BLM and USGS, by virtue of memorandum of understanding (Appendix D), have taken steps to clearly define their respective administrative and operational roles. The purposes and objectives are to: (1) minimize or eliminate environmental damage; (2) better serve industry and public interests; and (3) streamline the regulations and procedures for most efficient and uniform administration, operation, and industry compliance. This clarifies the administrative and operational roles of both BLM and USGS in regards to OCS pipeline management.

Each application for a pipeline right-of-way will be reviewed on a case by case basis by the BLM New Orleans OCS Office. When a decision is issued for approval of a pipeline application, it is stipulated that all valves and taps must be buried to a minimum of 0.3 m (1 ft) below the ocean floor at any depth. When the water depth of the right-of-way is less than 61 m (200 ft) the pipeline must be jet buried to a minimum of 0.9 m (3 ft) below the ocean floor. The Manager reserves the right to require or not require the burial of any BLM-permitted pipeline at any water depth. If a pipeline is not buried, the Manager reserves the right to require a permittee to later bury that line should it cause interference with commercial fishing activities. It is also stipulated upon approval by the manager that the proposed pipeline be designed, constructed, operated and maintained in compliance with applicable Department of Transportation Regulations.

The National Environmental Policy Act (NEPA) requires that the environment be taken into account, and an Environmental Impact Statement (EIS) be prepared for all major Federal actions which may have a significant impact on the environment. The procedures for the determination of whether or not an EIS is needed are set forth by the Council on Environmental Quality (CEQ). A document known as an "Environmental Assessment Record" (EAR) is prepared and is the basic tool used in making this decision. The Secretary of the Interior has determined that any lease sale is a major Federal action which will have a significant impact on the environment, and therefore, no EAR is necessary prior to a lease sale as an EIS must be prepared. However, for other OCS activities such as pipelines, structures or cathodic protection units for structures, an EAR is prepared on a site-specific basis.

Prior to any of the aforementioned activities, a permit application must be submitted along with the following items:

a. Specifications for the pipeline or structures.
b. An engineering hazards survey and report.
c. A cultural resource survey and report (if the site lies within the predetermined zones of high probability of cultural resource occurrence).
d. Construction information.

This information, along with environmental data from the area to be affected, is analyzed and the EAR is prepared.

The EAR consists of the following:

a. A description of the proposed action and alternatives.
b. A description of the existing environment.
c. An analysis of the proposed action and alternatives (i.e., major possible mitigating or enhancing measures, residual impacts, recommendations for mitigation or enhancement, analysis of alternative to the proposed action, relationship between long-term productivity and short term use, and irreversible and irretrievable impacts and commitment of resources.
d. An evaluation of the extent of public interest in the proposed action.

The EAR preparation is coordinated throughout, as required by Secretarial Order 2974, with the Bureau of Land Management, U.S. Geological Survey, U.S. Fish and Wildlife Service and U.S. National Park Service. If the pipeline is to come ashore, then the process is coordinated with the states(s) involved and comments on the proposed action are sought from state and local agencies.

In the event the pipeline does come ashore, onshore as well as offshore impacts to the environment are taken into consideration.

2. Measures Involving Military Uses of the OCS

Before tracts are offered for lease the Department of the Interior in consultation with the Department of Defense delete tracts which could unduly conflict with the national defense. Military operations offshore and nearshore could be

scheduled to avoid conflict with oil and gas operations. A special stipulation (Section IV.D.) provides for surveying the ocean floor in tracts where military munitions are suspected to have been jettisoned or lost.

None of the proposed lease tracts are located south of the thirtieth parallel, thereby avoiding conflicts with the primary zone of missile activity originating from the Kennedy Space Center.

3. Onshore Facilities

Of the four southeastern Atlantic states, the area of most intensive development pressure is in the three northerly states in the vicinities of their coastal cities: Wilmington, Charleston, Savannah and Brunswick. The Florida coastline has intermittant development from the Jacksonville area south to Cape Canaveral.

Although not exercising any direct control over land use except on federal lands such as military reservations, national parks and recreation areas, the federal government plays an increasingly important indirect role in the control of land use, particularly in coastal areas. Federal programs in certain fields are well established and exert a key role affecting land use in coastal areas. Most recent are the protective measures being introduced in coastal areas under the Coastal Zone Management Act of 1972, which authorized $171 million in grants to the states over five years to encourage the establishment of programs for planning, management, use, protection, and development of the Nation's coastal areas (VIMS, 1974).

The Coastal Zone Management Act Amendments of 1976, contained in the Report of the Committee of Conference (June 24, 1976) provides for additional means for states to study, plan for, manage, and control the impact of energy facility and resource development which affects their coastal zones. Energy facility means any equipment or facility which is used in the exploration for, or the development, production, conversion, storage, transfer, processing, or transportation of any energy resource or for the manufacture, production, or assembly of equipment, machinery, products, or devices which are involved in any activity described above. The amendments provide for a procedure to be followed in the event that a management program decision is in conflict with any local zoning ordinance, decision or other action.

A notice, proposed for inclusion in the leases awarded as a result of this proposed sale, provides that the lessee shall provide to the state and local communities for their review and comment a "Notice of Support Activity for the Exploration Program". This notice would be provided to all states directly affected by the lessee's action. The Notice shall include a description of the facility, the location and size, the number of persons to be employed, an estimate of the types and costs of equipment to be obtained within the state, and other information.

Regional planning is well established in the southeast coastal areas. Since 1965, this activity has been fostered by the activities of the Coastal Plains Regional Commission, a multistate economic development organization.

Since the main development control powers rest with counties and cities in this area, as they do in most southern states, the activities of the regional planning district councils are, with the exception of Florida, largely advisory to county and city governments. These Councils have become strong participants in the decision-making process, particularly where they have professional planning staffs which offer and frequently provide planning services to counties and communities in their region. Their advisory project review role is greatly strengthened in the case of any federally aided projects by the A-95 review procedures required by the Office of Management and Budget. Many of the councils have been designated as Regional or Metropolitan Clearinghouses for this purpose, and thus play an important role in the planning and development decision-making process in the counties and cities within their jurisdiction (VIMS, 1974).

a. ONSHORE OPERATIONS BASES

Any Federal involvement in regulating the siting of operation bases would be limited to situations where dredging and filling of navigable waters were involved. In those situations, a permit would be required from the Corps of Engineers after review and comment by appropriate agencies. Stipulations can be placed on the construction of such facilities as prerequisites to the issuance of a permit.

State involvement in the siting of an operations base would occur where their regulatory or review responsibilities apply or in their formal comments to the USGS on OCS operator supplied

development (minus proprietary information) plans.

B. PIPELINES

Federal responsibility in regard to onshore pipelines, both oil and gas, is divided among several agencies. The Materials Transportation Bureau in the Department of Transportation (DOT) has the primary responsibility for assuring pipeline safety. Their concerns address safety through pipeline design as well as construction and operational practices. Their responsibility is basically one of setting standards. Similar to offshore pipelines, the MTB is involved in pipeline safety and inspection to cause, by those responsible for the pipelines, the prompt reporting of any potential leaks or safety problems, and report annually to the President, the Congress, the Secretary of the Interior, and the Interstate Commerce Commission of any potential leaks or actual explosions and spillages in these pipelines.

The Federal Power Commission can authorize the bringing ashore of natural gas pipelines by issuing a Certificate of Public Convenience and Necessity. If the FPC feels it necessary, the agency prepares an environmental impact statement to evaluate marine and onshore impact of potential production from the pipeline.

The Corps of Engineers also becomes involved where a proposed pipeline crosses navigable waters. The wetlands legislation in the respective states could require permitting and environmental impact statements for pipelines proposed for construction through wetlands.

The Department of Interior and the Department of Transportation share responsibility for pipelines on the Outer Continental Shelf. According to information published in the Federal Register, (Vol. 41, No. 157, August 12, 1976) pipelines known as "flow lines" and "gathering lines" are under the jurisdiction of the Department of Interior. The Department of Transportation exercises exclusive responsibility for the safety regulation of oil and gas offshore pipelines downstream to the shore from the outlet flange of each facility where hydrocarbons are produced, or where produced hydrocarbons are first separated, dehydrated, or otherwise processed, whichever facility is farther downstream.

The Bureau of Land Management issues rights-of-way for pipelines, other than gathering or flowlines on the Outer Continental Shelf. It is the intent of the Bureau of Land Management to require transportation of crude hydrocarbons produced from leases awarded by this proposed sale by means of pipelines whenever the installation of pipelines is economically and environmentally feasible.

C. TERMINAL AND STORAGE FACILITIES

The Federal Water Pollution Control Act (FWPCA), as amended in 1972, provides for a National Oil and Hazardous Substances Pollution Contingency Plan for which the Environmental Protection Agency (EPA) and the Departments of Interior, Transportation and Defense all share responsibility. EPA, however, has the authority over onshore non-transportation facilities, such as terminal and storage areas. The operators of such facilities are required to prepare and implement Spill Prevention Control and Countermeasure Plans. The 1970 Amendments to the Clean Air Act established minimum standards for pollutants generated by evaporation from oil storage facilities. Oil transfer terminals will also normally be required to have a Coast Guard Operations Manual. The facility operator must make any design and operational adjustments necessary to meet the standards before the state will issue a permit to operate the facility. The four southeastern Atlantic states have approved state air plans pursuant to the Act. Consequently, the permitting programs are administered by the respective states with EPA having monitoring and oversight responsibility. These controls affect only the manner of operation of a facility. The location aspects are limited to the possibility that different locations may more readily accommodate additional facilities.

The primary means of affecting the siting of an oil terminal and storage area is the zoning power of the local government.

D. GAS PROCESSING PLANTS

The air emissions and water discharges emanating from these facilities would require permits under both the 1972 Amendments to the FWCPA and the 1970 Amendments to the Clean Air Act. In the latter case, all four southeastern Atlantic states have plans approved by EPA and consequently, the permitting systems are operated by the respective states with monitoring and oversight by EPA.

D. Special Stipulations

Leases for oil and gas exploration and development are subject to all OCS operating orders and regulations. Additionally, in some cases, special stipulations are attached to particular leases which require that measures be taken to protect specific resources or activities. In previous OCS oil and gas lease sales, lease stipulations have been implemented which provide for protection of biological and cultural resources, and for avoidance of conflict with military and other uses of the OCS.

Stipulations which are being considered for inclusion in this proposed sale are presented below. Although a decision has not been made as to the final wording of these stipulations, it is the Department's intent to include stipulations in certain leases, should the sale be held, as the most effective way of mitigating certain adverse impacts.

However, once a stipulation has been attached to a lease, it can only be effective if implemented with expertise and with consideration of all appropriate information. Several affected States have expressed the desire to be consulted in the implementation of lease stipulations. Secretarial Order 2974 (see Appendix E) provides for intra-Departmental coordination on matters of this sort. The Department will endeavor to develop jointly with the affected States, a process wherein their advice will be sought in areas of mutual interest.

It should be noted that stipulations 2 and 3 may, where required, be satisfied by a single survey which would utilize common instruments and procedures.

The following stipulations are proposed to be included in any lease issued, except as otherwise indicated below:

Stipulation No. 1 - Biological Resources - (to apply to all leases resulting from this lease sale)

Prior to any drilling activity or placement of any fixed structures or pipeline or any other exploration or production activity, the lessee will submit to the Supervisor as part of his exploration and/or development plan a bathymetry map, prepared utilizing remote sensing and/or other survey techniques. This map will include interpretations for the presence of live bottom areas within a minimum one-mile radius of the proposed exploration or production activity site.

For the purpose of this stipulation, live bottom areas are defined as those areas which contain biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography; or whose lithotope favors the accumulation of turtles and fishes.

If it is determined that the remote sensing data indicate the presence of hard or live bottom areas, the lessee will also submit to the Supervisor photo-documentation of the sea bottom near proposed exploratory drilling sites or proposed platform locations.

If it is determined that live bottom areas might be adversely impacted by the proposed activities, then the Supervisor will require the lessee to undertake any measures deemed economically, environmentally, and technically feasible to protect live bottom areas. These measures may include, but are not limited to, the following:

a. The relocation of operations to avoid live bottom areas.
b. The shunting of all drilling fluids and cuttings in such a manner as to avoid live bottom areas.
c. The transportation of drilling fluids and cuttings to approved disposal sites.
d. The monitoring of live bottom areas to assess the adequacy of any mitigation measures taken and the impact of lessee initiated activities.

Stipulation No. 2 - Cultural Resources - (to apply to all leases resulting from this lease sale)

If the Supervisor, having reason to believe that a site, structure or object of historical or archaeological significance, hereinafter referred to as '"cultural resource", may exist in the lease area, gives the lessee written notice that the lessor is invoking the provisions of this stipulation, the lessee shall upon receipt of such notice comply with the following requirements:

Prior to any drilling activity or the construction or placement of any structure for exploration or development on the lease, including but not limited to, well drilling and pipeline platform placement, hereinafter in this stipulation referred to as "operation", the lessee shall conduct remote sensing surveys to determine the potential existence of any cultural resource that may be affected by such operations. All data produced by such remote sensing surveys as well as other pertinent natural and cultural environmental data shall be examined by a qualified marine survey archaeologist to determine if indications are present suggesting the existence of a cultural resource that may be adversely affected by any lease operation. A report of this survey and assessment prepared by the marine survey archaeologist shall be submitted by the lessee to the Supervisor and to the Manager, Bureau of Land Management (BLM) Outer Continental Shelf (OCS) Office for review.

If such cultural resource indicators are present the lessee shall: (1) locate the site of such operation so as not to adversely affect the identified location; or (2) establish, to the satisfaction of the Supervisor, on the basis of further archaeological investigation conducted by a qualified marine survey archaeologist or underwater archaeologist using such survey equipment and techniques as deemed necessary by the Supervisor, either that such operation shall not adversely affect the location identified or that the potential cultural resource suggested by the occurrence of the indicators does not exist.

A report of this investigation prepared by the marine survey archaeologist or underwater archaeologist shall be submitted to the Supervisor and the Manager, BLM OCS Office for their review. Should the Supervisor determine that the existence of a cultural resource which may be adversely affected by such operation is sufficiently established to warrant protection, the lessee shall take no action that may result in an adverse effect on such cultural resource until the Supervisor has given directions as to its disposition.

The lessee agrees that if any site, structure, or object of historical or archaeological significance should be discovered during the conduct of any operations on the leased area, he shall report immediately such findings to the Supervisor and make every reasonable effort to preserve and protect the cultural resource from damage until the Supervisor has given directions as to its disposition.

Stipulation No. 3 - Ordnance Survey - (to apply to all leases resulting from this lease sale)

The lessee shall conduct remote sensing and/or other surveys as specified by the Supervisor to determine the existence of any unexploded ordnance, (munitions, mines, or bombs). The lessees' report to the Supervisor should document all indications of magnetic or sidescan sonar anomalies on the sea floor.

Stipulation No. 4 - Information Provided to States (to apply to all leases resulting from this lease sale)

To provide information to coastal states and thus assist them in planning for the impact of activities during exploration under this lease, the lessee shall submit, for review and comment, to the Governor of each South Atlantic state a "Notice of Support Activity for the Exploration Program" (hereinafter called "Notice").

For the purpose of this stipulation South Atlantic states include North Carolina, South Carolina, Georgia, and Florida. The lessee shall not be required to include privileged information in this Notice. At his discretion, the lessee may submit either a separate Notice for each Exploration Plan submitted on a lease under 30 CFR 250.34, or a Notice for two or more Plans on one or more leases. The Notice shall not be subject to approval or disapproval by the Supervisor.

A copy of the Notice shall be submitted to the Supervisor no later than the date of submission of the Exploration Plan, with a certification that the Notice has already been submitted to the Governor of each South Atlantic state. A lessee who submits a Notice for two or more Exploration Plans shall not be required to supply additional copies of the Notice, but may instead refer to that prior submission. Before the Supervisor approves or disapproves the Exploration Plan, he shall allow at least 30 days from the date of receipt of the certification for the Governors to submit comments on the Notice to the lessee. Subsequent to submission of the certification, significant changes in estimated support activities will be forwarded by the lessee, as an amendment to the Notice to the Governors of the South Atlantic states and the Supervisor.

The Notice shall include with respect to the lessee and his contractors:

(1) A description of the onshore and nearshore support facilities, including site, size, and timeframes expected to be constructed, leased, rented, or otherwise procured in affected areas;

(2) Amount and location of acreage expected to be required within the state for facilities, including the need for storage space for supplies;

(3) An estimate of the frequency of boat and aircraft departures and arrivals, on a monthly basis, and the possible onshore location of terminals;

(4) The approximate number of persons who are expected to be engaged in onshore support activities and transportation, and the approximate number of local personnel who are expected to be employed by or in the support of the exploration program;

(5) Estimates of the approximate addition to the population, on a county basis, due to the exploration program and the approximate number of persons needing housing and other facilities;

(6) An estimate of any significant quantity of major supplies, including water and energy, and equipment to be procured within the state; and

(7) The onshore address of the lessee's operation officers and of the contractors' offices involved in the exploratory operation.

Stipulation No. 5 - Transport of Oil and Gas - (to apply to all leases resulting from this sale)

If pipeline rights-of-way can be determined ard obtained, and if laying such pipelines is technically and economically feasible and environmentally preferable, pipelines will be required. The lessor specifically reserves the right to require that any pipeline used for transporting production to shore be placed in certain designated management areas. The lessor's decision regarding the selected means of transportation will be made within the context of an intergovernmental planning program for assessment and management of transportation of Outer Continental Shelf oil and gas with the participation of Federal, State, and local government and the industry. Where feasible, all pipelines, including both flow lines and gathering lines for oil and gas, shall be buried to a depth suitable for adequate protection from water currents, sand waves, storm scouring, fisheries trawling gear, and other uses as determined on a case-by-case basis by the Department of the Interior permitting agency.

Following the completion of pipeline installation, no crude oil production will be transported by surface vessel from offshore production sites, except in the case of emergency. Determinations as to emergency conditions and appropriate responses to these conditions will be made by the Supervisor. If the laying of pipelines is not feasible and surface transportation must be employed.

All surface vessels used for carrying hydrocarbons to shore from the leased area will conform with all standards established for such vessels by the Secretary of Transportation, pursuant to the Ports and Waterways Safety Act of 1972. 46 U.S.C. §391a.

Stipulation No. 6 - Department of Defense Restrictions - (to be included only in leases resulting from this lease sale for tracts 1 through 56)

(1) Whether or not compensation for such damage or injury might be due under a theory of strict or absolute liability or otherwise, the lessee assumes all risks of damage or injury to persons or property, which occurs in, on, or above the Outer Continental Shelf, to any person or persons or to any property of any person or persons who are agents, employees or invitees of the lessee, its agents, independent contractors or subcontractors doing business with the lessee in connection with any activities being performed by the lessee in, on, or above the Outer Continental Shelf, if such injury or damage to such person or property occurs by reason of the activities of any agency of the U.S. Government, its contractors or subcontractors, or any of their officers, agents or employees, being conducted as a part of, or in connection with, the programs and activities of the Operating Area Coordinator, Naval Base, Charleston, South Carolina. The lessee assumes this risk whether such injury or damage is caused in whole or in part by any act or omission, regardless of negligence or fault, of the United States, its contractors or subcontractors, or any of their officers, agents, or employees. The lessee further agrees to indemnify and save harmless the United States against, and to defend at its own expense the United States against all claims for loss, damage, or injury sustained by the agents, employees, or invitees of the lessee, its agents or any independent contractors or subcontractors doing business with the lessee in connection with the programs and activities of the United States, its contractors or subcontractors, or any of their officers, agents, or employees and whether such claims might be sustained under theories of strict or absolute liability or otherwise.

(2) The lessee agrees to control his own electromagnetic emissions and those of his agents, employees, invitees, independent contractors or subcontractors emanating from individual designated defense warning areas in accordance with requirements specified by the commander of the appropriate onshore military installation, i.e., Operating Area Coordinator, Naval Base, Charleston, South Carolina, to the degree necessary to prevent damage to, or unacceptable interference with Department of Defense flight, testing or operational activities, conducted within individual designated

warning areas. Necessary monitoring, control, and coordination with the lessee, his agents, employees, invitees, independent contractors or subcontractors, will be affected by the commander of the appropriate onshore military installation conducting operations in the particular warning area; provided, however, that control of such electromagnetic emissions shall in no instance prohibit all manner of electromagnetic communication during any period of time between a lessee, its agents, employees, invitees, independent contractors or subcontractors and onshore facilities.

(3) The lessee, when operating or causing to be operated on its behalf boat or aircraft traffic into the individual designated warning areas shall enter into an agreement with the commander of the appropriate onshore military installation, i.e., Operating Area Coordinator, Naval Base, Charleston, South Carolina utilizing an individual designated warning area prior to commencing such traffic. Such agreement will provide for positive control of boats and aircraft operating into the warning areas at all times.

Stipulation No. 7 - Department of Defense Restrictions - (to be included only in leases resulting from this lease sale for tracts 57 through 225)

(1) Whether or not compensation for such damage or injury might be due under a theory of strict or absolute liability or otherwise, the lessee assumes all risks of damage or injury to persons or property, which occurs in, on, or above the Outer Continental Shelf, to any person or persons or to any property or any person or persons who are agents, employees, or invitees of the lessee, its agents, independent contractors or subcontractors doing business with the lessee in connection with any activities being performed by the lessee in, on, or above the Outer Continental Shelf, if such injury or damage to such person or property occurs by reason of the activities of any agency of the U.S. Government, its contractors or subcontractors, or any of their officers, agents or employees, being conducted as a part of, or in connection with, the programs and activities of the Operating Area Coordinator, Naval Air Station, Jacksonville, FL. The lessee assumes this risk whether such injury or damage is caused in whole or part by any act or omission, regardless of negligence or fault, of the United States, its contractors or subcontractors, or any of their officers, agents, or employees. The lessee further agrees to indemnify and save harmless the United States against, and to defend at its own expense the United States all claims for loss, damage, or injury sustained by the agents, employees, or invitees of the lessee, its agents or any independent contractors or subcontractors doing business with the lessee in connection with the programs and activities of the United States, its contractors or subcontractors, or any of their officers, agents, or employees and whether such claims might be sustained under theories of strict or absolute liability or otherwise.

(2) The lessee agrees to control his own electromagnetic emissions and those of its agents, employees, invitees, independent contractors or subcontractors, emanating from individual designated defense warning areas in accordance with requirements specified by the commander of the appropriate onshore military installation, i.e., Operating Area Coordinator, Naval Air Station, Jacksonville, FL, to the degree necessary to prevent damage to, or unacceptable interference with Department of Defense flight, testing or operational activities, conducted within individual designated warning areas. Necessary monitoring, control, and coordination with the lessee, his agents, employees, invitees, independent contractors or subcontractors, will be effected by the commander of the appropriate military installation conducting operations in the particular warning areas; Provided, however, that control of such electromagnetic emissions shall in no instance prohibit all manner of electromagnetic communication during any period of time between a lessee, its agents, employees, invitees, independent contractors or subcontractors and onshore facilities.

(3) The lessee, when operating or causing to be operated on its behalf boat or aircraft traffic into the individual designated warning areas shall enter into an agreement with the commander of the appropriate onshore military installation, i.e., Operating Area Coordinator, Naval Air Station, Jacksonville, FL, utilizing an individual designated warning area prior to commencing such traffic. Such agreements will provide for positive control of boats and aircraft operating into the warning areas at all times.

Section 5

Adverse Environmental Impacts which cannot be Avoided should the Proposal be Implemented

A. Marine Organisms

As has been discussed above in Section III. B.1., routine oil and gas operations that will result should this proposed sale be approved will impact marine organisms only in the immediate location of platforms, wells and pipelines. These impacts are considered temporary and minor, especially in view of the vast areas that will not be affected. Stipulations, OCS Operating Orders, and U.S. Coast Guard regulations all serve to minimize these unavoidable impacts. To recapitulate, these impacts are: 1. A minor decrease in primary productivity will occur due to turbidity caused by the disposal of drill muds and cuttings and the bottom sediments stirred up during pipeline laying and burying operations. It is likely that in the vicinity of live (hard) bottom fishing areas this impact will be further mitigated by the shunting of the muds and cuttings to within about 10 m of the bottom, reducing the turbidity plume. In any event, turbidity will only be present during the drilling, laying, and burying operations, and will affect only a very small portion of the South Atlantic. 2. The drill muds and cuttings, and the sediments displaced during pipeline burial, eventually settle on the sea floor and in doing so may smother benthic organisms if the settling is heavy enough. Again, the area affected will be quite small and the impact temporary. In the case of muds and cuttings, the extent of the area affected may be reduced by shunting. In any event, there will be some burial, but experience has shown that the area will be rapidly recolonized. 3. In both 1 and 2 above, the possibility exists that toxic materials used in the mud mixtures (such as bacteriocides) may adversely affect some organisms. However, during long and extensive oil and gas operations in the Gulf of Mexico no ill effects due to such toxicity have been noted, and several studies have failed to document any toxic effect, probably because concentrations used are very low and the muds are rapidly dispersed and diluted in the sea water. Study of this aspect is continuing, however.

Should the biological stipulation (Section IV.D.) be adopted it would protect the live bottom communities in several ways. Primarily, a survey of any planned area of operation will be required which will identify live bottom communities. The stipulation then requires a review of the planned operation by the U.S. Fish and Wildlife Service, and the Bureau of Land Management. These agencies would subsequently submit recommendations to the USGS Supervisor for operational constraints, some possibilities for which are detailed in the stipulation. These operational constraints would enable the operation to proceed without smothering live bottom communities by the disposal of drill cuttings and without crushing the live bottom epifauna by the placement of exploratory drilling rigs or production platforms.

It is thus concluded that adverse impacts due to normal and routine operations will be minimal, insignificant, and temporary. The adverse impact that should be the most cause of concern is that of a major oil spill that reaches the shore or water shallow enough to allow the oil to reach the bottom (see also Section III.B.1.). Such a spill is certainly not considered routine or normal, but it must be considered. OCS Operating Orders and routine industry procedures and safety precautions should work to minimize the likelihood of such a spill and then operate to prevent a spill, should one occur, from reaching shallow water, but as discussed in Section III.A.5., it can be predicted statistically that some oil will reach such waters sometime during the operations proposed by this action. It should be noted, however, that such predictions do not consider either clean-up and containment action nor degradation of the oil during a lengthy time exposed to the sea. Taking all this into consideration, it is believed that due to the distance from shore of the wells that there will be little if any adverse impact to shallow waters or the shoreline due to any oil spill in the lease areas.

Finally, there is the possibility of an oil spill from a pipeline or a tanker close enough to these sensitive areas to cause a major adverse impact. Strict adherence to operating procedures and safety precautions must be ensured. Rapid response to any spills by cleanup and containment teams must be ensured. Regardless of such adherence, however, there will be some oil contamination of the environment due to chronic low level discharge ("leakage") if not to a major spill. While every effort must be made to minimize the damage due to such contamination, some damage should be expected if this lease sale is held, and must be considered part of the cost of developing oil and gas on the OCS.

B. Shipping and Navigation

Should the cultural resource stipulation (Section IV.D.) be adopted and an archaeology survey required prior to exploration, the likelihood that petroleum related activities would endanger an unknown or expected historic shipwreck object or early man living site would be further reduced on the South Atlantic OCS. The effectiveness of remote sensing surveys can vary depending on factors such as instrumentation, professional interpretation, technique, and physical conditions such as water depth and weather conditions. The provisions of the stipulation assures professional involvement in determining where surveys will be required and interpretation of data collected. Should the stipulation be adopted instructions as to instrumentation, navigation, line spacing and report format requirements will be specified in a notice to lessees and operators. Appendix N includes a sample notice currently utilized in the Gulf of Mexico. Instrumentation utilized, record quality and line spacing can all affect the ability of the professional interpreter to identify and define signatures from potential cultural resources. All areas or objects identified and interpreted by a professional underwater archaeologist as a potential cultural resource would be either avoided, protected and/or identified and mitigated in accordance with prescribed regulations. With no prior petroleum activity in the proposed lease area there is low probability of non significant cultural material such as well heads, debris and pipelines masking or interfering with remote sensing equipment. In summary, implementation of the cultural resource stipulation prior to exploratory drilling or construction on the South Atlantic seabottom would further minimize the probability that a cultural resource would be negatively affected by this lease proposal.

Interference between offshore structure and vessel traffic will occur, but it will be minimal. An estimated maximum of 10-25 platforms may be required to develop the proposed lease area. Only a small portion (2-5 ha) of the lease would be utilized by platforms in such a case. As there are no navigational fairways established for the South Atlantic OCS region any platform placed in the region has the potential of constituting a navigational hazard for vessels moving through the immediate vicinity. The small number of platforms projected and the fact that all platforms and offshore facilities must be equipped in accordance with United States Coast Guard regulations (Appendix F) to maximize visibility and minimize collision hazard indicates that the impact will be minimal.

C. Commercial Fisheries

As described in Section III.C.6., trawling operations suffer interference and inconvenience from oil and gas operations in several ways. A small area of the sea floor, up to 0.017% (approximately 0.4 hectare) of each tract leased, is occupied by drilling rigs and platforms and is unavailable to trawl fishermen. Based on past exploration success rates, up to 101 hectares of sea floor (less than two percent of the total acreage offered) may be occupied by platforms resulting from this proposed sale. Trawl nets reportedly become snagged on underwater stubs and unburied pipelines, causing damage or loss of the nets. Less frequently, large objects which were lost overboard from supply boats and platforms are caught in trawling nets, resulting in damage to the net and/or its catch of fish; however, frequency of occurrences of this type of incident is low.

Commercial fishermen would probably not trawl in the area of an oil spill, as spilled oil could coat or contaminate commercial fish species, rendering them unmarketable. This would be another adverse effect to commercial fishing.

D. Recreation and Allied Resources

Oil spills (including those from pipelines) which may occur as a result of OCS oil and gas operations could result in unavoidable adverse effects on recreation areas and coastal recreation activities. Since recreation is the predominant use of shoreline in much of this region, it is possible that the oil from any such spill could beach in areas that are used for recreation purposes. Such occurrences could result in the localized short-term curtailment and/or dislocation of recreation participation. The magnitude of the effects on recreation opportunities could vary significantly based on a number of relevant factors: the size of the spill, location of the beaching, time of the year and availability of clean-up equipment. A large spill beaching on a popular recreation area such as Cape Hatteras National Seashore during the summer, for example, would unavoidably impact the thousands of recreationists who would normally enjoy this beach area during the days or

weeks required to remove the contamination and restore the sand. Although adverse effects on recreation are not certain to result from oil spills, and actions can be taken to minimize their likelihood, they are nevertheless not totally unavoidable. Spilled oil and debris which would float in the water or wash up on a shoreline recreation area would also severely detract from the aesthetic value of the contaminated area as well as adjoining areas or within perceptible range of the unavoidable damage.

The onshore facilities associated with OCS development have the potential to generate adverse impacts but such potential can be eliminated through preventative actions.

Unavoidable damage to cultural resources would occur when structures are not preserved or are not identified in time to take action for their preservation. Sites or objects which remain undiscovered could be damaged or destroyed partially or wholly if excavation occurs; however, the incidence of damage on the Outer Continental Shelf is likely to be low.

Other damage to archaeological resources could come from oil contamination. Historical and archaeological materials soiled by an accidental oil spill may not survive subsequent cleaning and restoration efforts. Porous materials could be rendered unsuitable for carbon dating techniques. The probability of such a polluting event for significant resource destruction appears small although it does exist.

Adoption of the transportation stipulation (Section IV.D.) may lead to the utilization of pipelines over tankers when and if an economic production level is reached. The scenarios of development indicate several possibilities; i.e., pipeline to shore, tankered to an out-of-area refinery, pipeline to a to-be-built refinery, or tankered direct to an out-of-area refinery. See VIII.E. and Appendix K for further discussion of the various scenarios. Other possibilities exist as well, a possible one is pipeline or barging of production to an onshore terminal, then tankered out of the area. See Table III.A-5.2 for a summary of tanker/pipeline differences.

When and if pipeline laying is economical, water surface transport will be reduced. This may reduce the possibilities of vessel collision and perhaps lessen localized constraints to navigation.

E. Beaches and Wetlands

Unavoidable adverse impacts to beaches and wetlands as a result of this proposed sale would be caused by oil spills and pipeline emplacement. Oil that may be spilled in the vicinity of the proposed lease tracts and does reach land would be primarily in the form of tar balls or heavy residues, whereas spills nearer to shore (from tankers or pipelines) may produce heavy coatings or patches. Heavily contaminated beaches will be rendered unsuitable for recreation so long as they remain coated with oil. Tar patches or balls would reduce recreational use or enjoyment until the beaches are cleaned. Beaches are most sensitive to impacts on recreation during the spring and summer, their seasons of greatest use. If any beach area is contaminated by oil, an undetermined amount of wildlife habitat would be damaged, primarily for birds, crustaceans, and molluscs. Oil that is buried or seeps into sand may not be totally degraded over time, thus, possibly returning to the surface in the future and providing a problem for recreational use.

Removal of oil contaminated sand may lead to erosional problems unless enough materials are available to replace it. Beaches that have been affected by an oil spill during the recreational off-season may suffer a negative impact during the following spring until the publicity of the spill has dissipated and the evidences of the clean-up are removed. Use of dredging equipment to remove contaminated marsh would impart further damage by increased turbidity and disturbance of mud bottoms. It may take up to several years for a dredged area to fully revegetate.

Oil spills which impact a salt marsh would kill vegetation and damage biological habitats from a few months to as much as several years before recovery.

From zero to two pipelines may come ashore, crossing beach or marsh or both, causing short term damage in 9-15 m (30-50 ft) wide swaths. All vegetation and non-motile animals lying directly in the path of the pipeline would be killed during pipeline laying. Some slight damage may also be rendered to beach and vegetation in adjacent areas by machinery used in the operation. Shoreline will return to its natural state over a few tidal cycles in the swath zone, however, beach ridges and dunes may take up to several years to recover. Long term impacts of crossing

marshes may include salt water intrusion, possible alterations in localized flora, and increases in marsh erosion at the site where the pipeline crosses the marsh. If the pipeline crosses a fresh water marsh, which serves as a recharge area for a ground water aquifer(s), some local ground water supplies could be contaminated.

F. Vegetation

Should stipulation No. 5 (Section IV.D.) be implemented, it is likely that, because of lowered tanker travel, there would be a lower amount of petroleum hydrocarbons introduced into the ocean, thus a lowered amount of oil residue on beaches with a concommitant lower impact on biologic and recreation resources.

The geographical location of the two assumed landfalls indicate that wetlands would not be expected to be impacted to any great degree.

It should be kept in mind that local, state, and Federal regulatory authorities are in the final determinants of pipeline construction, placement, and mitigatory stipulations. The consistency provisions of the Coastal Zone Management Act, OCS Operating Order No. 15, and proposed stipulation No. 4 further assure interlevel cooperation and agreement.

Some impacts resulting from pipeline burials and related construction activities on the vegetation will be unavoidable. Pipelines and construction activities can be located to avoid fragile areas and will be evaluated in a separate pipeline corridor study. Impacts will be localized and restricted to construction sites.

Vegetative communities have been shown to suffer adverse impacts from chronic exposure to oil which can result in denudation. The impact of a single oil spill depends, to a large extent, on various factors such as type of oil, time of year and plant species involved. It is believed that plant communities could survive moderate oilings.

G. Wildlife

Oil spills from offshore platforms and/or pipelines will have an adverse impact on wildlife species.

There may be an unavoidable adverse impact on marine mammals (Section III.B.5.). Although a direct impact has not been demonstrated, an indirect adverse impact may occur due to habitat and/or food source loss.

There will be an unavoidable adverse impact on pelagic bird species from offshore oil spills (Section III.B.6.). It has been well documented that bird species which feed by diving into the water are adversely impacted by offshore oil spills.

Time of day, time of year, sea conditions and type of oil all are some significant factors which will determine the extent of adverse impacts.

Nearshore spills resulting from pipeline or tanker accidents (if tankers are used) pose the highest threat to wildlife species. Areas surrounding pipeline routes would be the most vulnerable to nearshore spills. Previous spills indicate that sea birds such as gannets, pelicans, petrels and phalaropes receive the greater impacts and their fatalities can be large. Onshore species such as the American oyster catcher, piping plover and Wilson's plover can also suffer from spills due to loss of feeding and nesting habitats.

Opossums, raccoons, muskrats, minks and other small game animals can also suffer fatalities resulting from spills. While some species may experience direct impacts, they could also be affected by ingesting the oil during grooming activities. Scavengers and foragers could also eat oil-contaminated food, thereby ingesting petroleum. While ingesting hydrocarbons can be toxic to some species, hydrocarbon ingestion in animals is not well understood at present (Appendix I).

Pipeline burials and related construction activities will have some impact. This type of impact, however, can be minimized by avoiding particularly sensitive habitat areas. Adverse impacts of this activity will be evaluated in more detail in a separate pipeline management study if an economical oil and/or gas reserve is found in the South Atlantic lease area.

H. Land Use

The impact of facilities and growth induced as a result of the proposal, and their effect on land use could be significant on a community or subcounty basis, but it is perhaps the most susceptible to mitigation of all sale-induced impacts.

Unavoidable land use impacts, such as those resulting from pipelaying and other land disturbances are localized and short-term in nature, and generally affect 50-100 foot corridors or individual parcels of land. There will be a long-term commitment of between 45 and 112 ha of land for OCS-related facilities. This would consist

of up to 36 ha of industrial land for operation bases and service support facilities, up to 47 ha of rural land for processing plants or terminals, up to 24 ha of waterfront land for barge terminals and supply boat bases, and about 0.5 ha of office space. Also the development of an additional amount of land as a result of incremental induced development and population, is unavoidable. The greatest amount of development is anticipated to occur in the areas around Savannah, Ga. and Charleston, S.C. Development may also occur around Jacksonville, Fla. and possibly Brunswick, Ga.

Possible long-term land use conflicts which could result from this sale, such as conflicts between different adjoining land uses and competition for different uses, are usually avoidable through the exercise of existing regulations and controls. The implementation of coastal zone management plans beginning in 1977 should allow further prevention of land use conflicts in coastal areas.

I. Socioeconomic

Increases in the population of a particular area due to net in-migration as a result of direct investment in the area, in addition to the locating of primary industrial facilities to support the action, cannot be avoided should the action be taken and recoverable amounts of oil and gas be found. Primary facilities include exploratory rigs, platforms, terminals, storage facilities, onshore operations bases, gas processing plants, and service support facilities. Population increases would be directly related to the locational and investment tendencies associated with these facilities.

Unavoidable adverse impacts upon the physical and service system infrastructure as a result of OCS-induced population impacts would depend upon the availability, capability and elasticity of the infrastructure system of the area in which the induced population growth takes place. Visible adverse impacts, such as overutilization of infrastructure systems, inability of the systems to absorb and/or accommodate the additional population, will be most pronounced in areas having limited or underdeveloped infrastructure systems and/or comparatively small populations.

In large highly urbanized and industrialized areas the influx of population would not be as great due to labor force availability within the area. Because of the larger existing population, OCS-associated increases would not be perceptible. The ensuing infrastructural impacts, though unavoidable, would be negligible.

A part of the problem in determining the adverse socio-economic impact that may result from proposed sale related activities lies in the relative capability of the existing infrastructure in two areas, the area in which emigration occurs, and the area in which immigration occurs, and the ability of the existing infrastructure to provide the required services. Population movements from an area characterized by an insufficient supply of public services to an area with a more adequate supply of public services can be perceived as an action that would not be expected to increase the stress on the total infrastructure of both regions. And, conversely, a movement from an area with an adequate infrastructure to an area lacking in the capability to serve additional population could be conceived as having an adverse impact on the total ability of both infrastructures to provide the same level of services that formerly prevailed.

The migration of labor, capital, and materials to primary impacted areas from areas outside and within the U.S. South Atlantic coastal region during the early years of oil and gas operations, and the subsequent out-migration of some of these resources during the later years cannot be avoided should the action be taken and recoverable amounts of oil and gas be found.

When a given area is unable to absorb needed increased infrastructure expenditure and economic activity and excess resources are unable to be shifted elsewhere, problems in shortages of supply of services may develop.

Because of the diversity of the coastal regions of these states, development could be expected to occur in areas with varying degrees of industrialization and population density, although probably only to a limited extent in any area. Therefore, a combination of the impacts described above could be expected to occur.

A condition of uncertainty and less than perfect information will also create adverse impacts. To the degree that decisions are based on predictions or estimates that prove to be in error over time, adverse impacts will occur to firms in the form of commercial ventures that do not cover their costs. It is not likely that uncertainty could be completely removed from the decision making process. Uncertainty with regard to the level of recoverable resources in the leasing area, the actions of

others, and the economic climate is sure to remain. Private industry and government, while basing their decisions on as much information as possible, will be unable to avoid the adverse impacts caused by uncertainty.

An additional complication is evident in that socio-economic impacts resulting from this proposed sale will occur in a future socio and economic climate that will be the resultant of trends currently developing, as well as factors that may be of increasing importance in the near future, and that the socio-economic changes induced by proposed sale related activities will be only a portion of the changes expected to take place.

J. Water Quality

1. Offshore

Normal offshore operations would have unavoidable effects of varying degrees on the quality of the surrounding water if the proposal is implemented. Drilling, construction, and pipelaying would cause an increase in the turbidity of the affected waters for the duration of the activity, and, in the case of pipelines, could disturb settled pollutants in old dump site areas. The total amounts of resuspension of sediment as a result of a pipelaying activities can only be estimated because the width of the trench varies with the compactness and fluidization point of the sediment. If the trench were roughly two meters deep by two to four meters wide, and a parabolic cross-section is assumed, approximately 1,400 to 3,800 cubic meters per kilometer would be removed, some of which would be resuspended. A turbidity plume 20 m wide and 800 m long (plumes of this approximate size have been observed in the Gulf of Mexico) would also be created by the discharge of drill cuttings and the adherent drilling fluids. This, would only affect waters in the immediate vicinity of the rigs. The discharge of treated sewage would increase the levels of suspended solids, nutrients, chlorine, and BOD in a small area near the discharge point. Formation waters carrying mineral salts and regulated concentrations of hydrocarbons (present limits are set at 50 ppm, after 1977, the limit will be 48 ppm, after 1983, it will be 30 ppm) would also affect the water quality of the area when discharged. Throughout a 25 year production life, it can be estimated that the ratio of the total barrels of produced salt water to the total barrels of produced crude oil will be 1:1 (Appendix B). This would amount to approximately 0.282 to 1.009 billion barrels of produced water and approximately 8,460 to 30,270 barrels of oil introduced into the sea. This oil would create an incremental increase in the volume of oil lost to the sea each year. As such it could add to the overall deterioration of the ocean's quality. All of the above discharges are regulated by proposed OCS Orders and EPA regulations.

In the case of an accidental spill or pipeline break, unavoidable deleterious effects would result. Spilled oil that is not recovered would release hydrocarbons and trace metals that would have toxic or narcotic effects on any nearby life forms as it dissolves and evaporates. The quality of the surface, near surface, and to a lesser extent, deeper waters would therefore deteriorate during the life of the spill. If oil is entrapped in bottom or on shoreline sediments this degradation would continue over weeks or months as the oil is slowly reintroduced into the system.

2. Onshore

Increases in the population, commercial, and industrial sectors would undoubtedly add to the pollutant loadings of the waters of the region. The water quality is already in a poor state in some urban areas such as Charleston, S. Carolina, Savannah, Georgia and Jacksonville, Florida. The already over taxed treatment plants would not be able to handle an increase, however, these plants are presently under re-evaluation and improvement are being made to increase their capacity. Increases of 10-100% in municipal sewage loadings and industrial effluents could occur, but their effects would be at least partially mitigated by the enforcement of permit programs for point sources and more stringent water quality standards. The water pollution resulting from the runoff from new construction sites would also be an unavoidable effect. Estimates of volume are not currently available.

K. Air Quality

1. Offshore

Normal offshore operations will have unavoidable effects on the quality of the air surrounding rigs and platforms but because of the isolation of the structures, the low levels of emissions, and the prevailing winds, any increase in pollutants would be incremental and the overall air quality

would not deteriorate. In the case of an accident, oil and gas would be introduced into the environment and unavoidable, deleterious effects would result. Escaping natural gas would introduce methane, hydrogen sulfide and other hydrocarbons into the air. These, however, would disperse almost immediately. If the gas burned, carbon dioxide, water vapor, nitrogen oxides and sulfur dioxide would be produced. If a gas pipeline leak occurred near shore, the sulfur dioxide and nitrogen oxides could cause problems of malodorous smells, depending on the volumes released. If the accident involved oil, either an accidental spill or pipeline break, various types of hydrocarbons would volatilize and mix with the air mass which could produce toxic or narcotic effects on the local biota. If the oil burns, carbon dioxide, water vapor, sulfur dioxide, particulate carbon, nitrogen dioxide, and partially oxidized compounds would be produced and would lower the existing level of air quality in the area. If this occurred near shore, the pollutants would also create problems of haze and soiling on land. The actual degree of degradation is not predictable at present.

2. Onshore

The Harris Model indicates that for the region as a whole during peak production years in the mid 1980's the increase in population is less than one percent in most commercial and industrial sectors. The additional amounts of pollutants that would be added to the air would be insignificant. However, any effects that might occur would be mitigated by EPA's emission controls of automobiles, air emission guidelines for industries, and limitations on the allowed increments of pollutants in various areas (non-significant deterioration of air quality limitations). If most of the development occurs in metropolitan or industrialized areas only incremental percentage changes in the pollutant level of the air would occur. The most likely increase would be in suspended particulate matter. These increases could cause significant problems only in those localities in which standards were being exceeded at the time such as Charleston, S. C., Savannah, Ga. and Jacksonville, Fla. EPA has recently issued a policy of trade-off regarding HC emissions, Federal Register, December 21, 1976, 40 CFR part 51. This policy provides for the introduction of industries that are in the national interest or that are needed economically if a trade-off is made with the industry that is already in the area. Therefore, instead of increasing emission levels in that area there would not be an increase, only an exchange of industry type. However, if development occurs in the less densely populated and less developed areas within the region, greater percentage increases will result although, since the air quality in these areas is good, the actual effects would be modified by a large dilution factor. Temporary, localized increases in levels of hydrocarbons and carbon monoxide, due to the increase in automobile and truck traffic, would be especially notable. In both cases, the rise in levels of surfur oxides resulting from treatment of gas at the processing plants would represent the greatest change. In no area would the increased activity be expected to cause air quality standards to be exceeded if they were not being exceeded already.

Since onshore development is anticipated to take place in areas with varying degrees of industrialization, population density and ambient air quality, a combination of the impacts described above could occur. However, the extent of development which may take place in major metropolitan areas is expected to be limited.

Section 6

Relationship Between Short-Term Uses of the Environment and Enhancement of Long-Term Productivity

The proposed leasing of 518,400 hectares (1,280,966 acres) of the Southeast Georgia Embayment area is the first Federal oil and gas leasing proposal in the South Atlantic OCS. In general, the leasing for oil and gas development as a result of this proposal would not result in any large tradeoffs between short-term uses of the environment and the long-term productivity of the environment with regard to a specific natural resource. Rather, it will result in tradeoffs, in both the short-term and the long-term, between the use and allocation of different resources.

The principal exception would be the use of extracted oil and gas resources, expected to range from 0.3 to 1.0 billion barrels of oil and 1.0 to 6.8 trillion cubic feet of gas. The extraction and consumption of mineral resources would preclude their use at a later date and would result in lower reserves in the long-term, since at least in the human time-frame, oil and gas are nonrenewable resources. The short-term use of oil and gas resources over the estimated 25-year field life of this proposed sale would not, however, necessarily affect long-term development and production or availability of energy sources in general, or the long-term productivity of the environment. This would especially be the case should either no oil and gas be discovered, or if oil and gas are not found in commercial quantities as a result of this proposed sale.

However, this proposal could result in the discovery of recoverable resources over the high end of the estimated range (1.0 billion barrels of oil and 6.8 trillion cubic feet of gas, see Appendix B), thereby opening this area to successive future sales similar to events in the Gulf of Mexico. If this should occur, that period considered short-term (25 years) could extend considerably beyond this time-frame, to 30 to 40 years, and therefore could be considered as having long-term effects on the productivity of the offshore and onshore components of the South Atlantic environment. Such future sales and the resulting extension of OCS-related oil and gas activities in this South Atlantic region could especially effect the long-term productivity of the biological communities, fishing activities in the vicinity of offshore facilities, onshore areas utilized for facilities directly associated with OCS operations and support facilities by extending the periods of impact as discussed in Section III.

With regard to this proposed sale, the induced development and populations increase may result in short-term adverse impacts to communities. A strain on existing infrastructure would be expected if new OCS-related facilities are located in areas of low population with little current industrial base. However, in the long-term, a return to equilibrium can be expected as population gains and induced industrial development are absorbed in the expanded communities. Incremental long-term gains in levels of employment per capita income can be expected to accrue.

Short-term impacts to the marine coastal environment would result from this proposal. There would be short-term adverse effects as a result of construction operations, in the form of resuspension of sediments, turbidity and land disturbance affecting local populations of organisms. Short-term adverse affects to these populations would also occur as a result of oil spills.

Short-term impacts could also occur to the recreation values and tourism economy of the area if an oil spill of considerable size should occur.

There would also be an unknown amount of long-term degradation of the environment due to the chronic introduction, through operations, of small amounts of oil and other substances, such as trace amounts of heavy metals from drilling muds, into the marine and coastal environment over the life of this proposed oil and gas operation. Evidence available at this time does not indicate any long-term adverse impacts on biological productivity as a result of the introduction of such substances into the environment; however, it is not possible at present to conclude that no adverse long-term impacts would result.

In addition, the short-term use of the OCS for mineral extraction will preclude fishing in the immediate vicinity of oil and gas operations removing a maximum of approximately 873-1821 ha (2156-4499 acres) at any one time from commercial fishing activity.

Approximately 45-89 ha (110-220 acres) of land utilized for facilities directly associated with OCS operations will be excluded from other uses over the 25-year life of the field; however, only a portion of this land area may continue to be utilized after production ceases.

In summary, short-term localized adverse environmental and socio-economic impacts would result from this proposed sale. Long-term adverse

environmental effects can be expected, potentially some of which are unknown at this time. Oil and gas reserves would be lowered as well. Few long-term productivity or environmental gains with regard to natural resources are expected as a result of this proposed sale. Benefits as a result of this proposed action are to be expected in other realms--principally those brought about as a result of increased supplies of domestic oil and gas.

It should be noted that since this proposal would be a first sale in a frontier area, this action could lead to future sales in the area. While a decision to hold a sale is made on an individual, sale-specific basis, a sale in a frontier area, if resources are discovered, would undeniably provide incentive for additional sales. Any future proposals for additional sales in the South Atlantic is subject to the same procedures to which this proposed sale is subject, including environmental assessments, and environmental impact statements.

Section 7

Irreversible and Irretrievable Commitment of Resources

A. Minerals Resources

Leasing of the tracts in this proposed sale would permit development and extraction of the oil and gas resources contained therein. Estimates by USGS of net recoverable resources range from 0.3 to 1.0 billion barrels of oil and from 1.9 to 6.8 trillion cubic feet of gas. More than one mineral lease may be issued for the same area for the retrieval of other types of minerals, but CFR 43, Part 3307, 4-5 provides that other leases may not unreasonably interfere with or endanger operations of any existing lease.

Technology presently exists to extract sand, gravel, phosphorite and manganese deposits from the ocean floor. No impact on future mining of these resources as a result of oil and gas operations may be expected except in the case of production and pipeline facilities. That portion of the bottom used for those purposes would be removed from any future dredging operations during the lifetime of the field. Leasing of the proposed tracts could represent an irreversible and irretrievable commitment of hydrocarbon resources.

B. Fish and Wildlife Resources

An irreversible or irretrievable commitment of fish and wildlife resources and their habitats could occur in the area of a massive oil spill or if frequently subject to chronic low levels of oil pollution. It is anticipated, however, that an affected area will recover from a spill and that the natural flora and fauna would eventually reoccupy spill areas. While individuals of the 24 endangered species found within the area of this proposed sale (see Table E-15, Section II.) may be eliminated, it is considered highly unlikely that an entire species or population of a species could be eliminated due to any actions resulting from this proposed sale. However, the loss of even a small part of the population can be of major consequence to the survival of an endangered species. The greatest danger to these species would occur if oil from a spill destroyed a nesting area, but the arrival of sufficient quantities of oil ashore to cause such destruction is considered unlikely. Construction of facilities ashore could also damage habitat, and care must be taken in siting such facilities so as to preclude damage. There is insufficient evidence to conclude that low-level spillage or other activities associated with the proposed sale can lead to an irreversible commitment of fish and wildlife resources.

C. Recreational and Allied Resources

Any damage to cultural resources such as archaeological or historical sites or artifacts either known or undiscovered would result in an irretrievable commitment of nonrenewable resources. Their usefulness and value would be either lessened or lost as the result of oil spills or construction damage. Likewise public appreciation of cultural or wildlife resources irretrievably lost as a result of this proposed sale would be foregone.

D. Land Resources

The proposed sale would require approximately 45-108 ha (110-270 acres) of land for large OCS-related facilities with possibly another 14 ha (35 acres), for small facilities as well as acreage for pipeline rights-of-way. In addition, an undetermined amount of land to accomodate induced population growth would be required. Potentially, additional land for facilities stimulated in part by this proposed sale could also be required. Land use requirements for induced population growth have not been estimated because they would depend in part on how much of the population increase could be absorbed by existing excess capacity (in housing for example) in localities which receive the increases.

While these uses may be long-term, they are not generally considered irreversible. However, where new land uses result in the disruption or destruction of natural features or processes, such that return to the previous land use is not possible, an irreversible commitment of resources would occur. An example of such a commitment would be the conversion of wetland areas to other uses. Because of the relatively small amount of acreage required and the land use controls available to states and localities, we do not believe that such an irreversible commitment of those resources would result from this proposed sale.

E. Human Resources

Since 1954, when Outer Continental Shelf leasing began, through February 1976, there have been 75 deaths directly associated with drilling operations in the Gulf of Mexico. In addition, there have been numerous deaths associated with oil and gas production on the OCS including

helicopter crashes and boat accidents. It will be impossible to avoid all human casualties, but they have been minimized through measures already implemented which are continually updated to improve the safety of OCS operations. Fatalities and/or permanent impairment as a consequence of accidents and personnel error will result in an irreversible and irretrievable commitment of human resources.

F. Economic Resources

This proposed sale would result in production of certain OCS-related goods and services, including investments in required facilities, stimulation of certain industries within the region, and if recoverable resources are proved, oil and gas. To the extent that resources would be drawn away from other uses, production of goods and services in other areas or of other types would possibly have to be foregone. Limited resources such as steel products, specialized manpower and capital constitute required resources and the use of these resources to develop this proposal would mean that other opportunities for their use might have to be foregone. While these resources may be reclaimed over time, their use as a result of this proposed sale would constitute an irreversible and irretrievable commitment of resources at a given point in time.

To the extent that unemployed resources are used, the employment of resources as a result of this proposed sale would not constitute a cost to society in the form of foregone opportunities.

G. Summary

Except for the potential loss of: human life, investment, oil and gas resources, and archaeological resources; there are no other irreversible and irretrievable commitment of resources.

Section 8

Alternatives to the Proposed Action

A. Hold the Proposed Sale in Modified Form

1. Substitution of Tracts Within the Area of the Call For Nominations (Figure VIII-1).

One alternative considered during the tract selection process relating to proposed OCS Sale 43 was the offering of a different group of tracts included within the area of the call for nominations. In response to the call for nominations, industry expressed interest in a total of 778 tracts.

Proposed Sale No. 43 consists of 225 tracts, and therefore did not include all of the tracts for which nominations were received. An alternative sale offering consisting of 225 tracts could have been selected from the area included within the call for nominations.

For example, an offering of 225 tracts, all of which had some degree of industry interest, could have been composed of the following blocks (See Figure VIII-1). Reference is made to the production areas defined in the discussion of the Department of the Interior Oil Spill Trajectory Model (See Appendix M).

Production Area 1 and vicinity
Protraction Diagram James Island NI 17-12
Blocks 67, 68, 111, 112, 155, 156, 198-206, 242-250, 286-294, 330-338, 374-382. Total 51 blocks
Production Area 2 and vicinity
Protraction Diagram NH 17-3
Blocks 6, 7, 50, 51, 52. Total 5 blocks
Production Area 3 and vicinity
Protraction Diagram Savannah NH 17-11
Blocks 299-302, 343-346, 387-389. Total 11 blocks
Production Area 4 and vicinity
Protraction Diagram Brunswick NH 17-2
Blocks 780-786, 825-830, 868-878, 912-922, 956-966, 1000-1010,
Protraction Diagram Jacksonville NH 17-5
Blocks 33-42. Total 67 blocks
Production Area 5 and vicinity
Protraction Diagram Savannah NH 17-2
Blocks 911, 955, 999
Protraction Diagram Jacksonville NH 17-5
Blocks 29-32, 73-75, 117-119, 161-163, 205-206. Total 18 blocks
Production Area 6 and vicinity
Protraction Diagram Jacksonville NH 17-5
Blocks 76-81, 120-123, 164-168, 207-211, 254-256, 297-298, 341-342, 385-386, 429-430, 473-474, 516-518. Total 36 blocks
Production Area 7 No blocks offered Total 0 blocks
Production Area 8 and vicinity
Protraction Diagram Jacksonville NH 17-5
Blocks 257, 299-301, 343-344, 387-388, 431-436, 475-479, 519-523, 562-566, 606-609, 650-653. Total 37 blocks

If this group of blocks had been included in the tracts offered in the sale instead of the tracts included within proposed Sale 43, some changes and modifications may have resulted in impact producing factors, such as the number of wells and platforms and quantities of drill cuttings, muds, produced waste water and solid waste.

However, the Geological Survey, in response to a request for estimates relating to Sale No. 43 pointed out that estimates of resource potential are inherently speculative, particularly so in areas, such as the South Atlantic OCS, where geologic information is limited and the presence of oil and gas has not been demonstrated. Further, the Geological Survey emphasized that operational projections and estimates are highly speculative and represent a possible development scheme based on many variables and assumptions.

This group of blocks considered for leasing contains a number of blocks in which industry interest was less than in the blocks included within proposed Sale 43, and it is possible that, if this alternative selection had been offered, fewer blocks would have been leased, and a lesser number of wells and platforms would be required. It is also possible that lesser quantities of oil and gas would be discovered.

However, it is considered most likely that the numbers of wells and platforms, and quantities of oil and gas, cuttings, and solid waste, and other estimated impacts that would be anticipated to result from this alternative selection of tracts would be within the same ranges as the estimates specifically provided for proposed Sale 43, and therefore, the basic development assumptions remain the same as described in Section I.

The risk of an oil spill impacting another resource is believed to be the same as the risk present in the proposed sale, and no modification in the estimated onshore locations of service, transportation, or support facilities would be required.

IMPACTS FROM THIS ALTERNATIVE

The impacts associated with this alternative would probably be the same as the impacts discussed within this impact statement, since the development assumptions remain the same.

This alternative offering would have included an additional number of tracts within the possible area of "live bottoms", possibly as many as 60 blocks. Thus the effect on fishing would be greater than described in Section III.C.6.

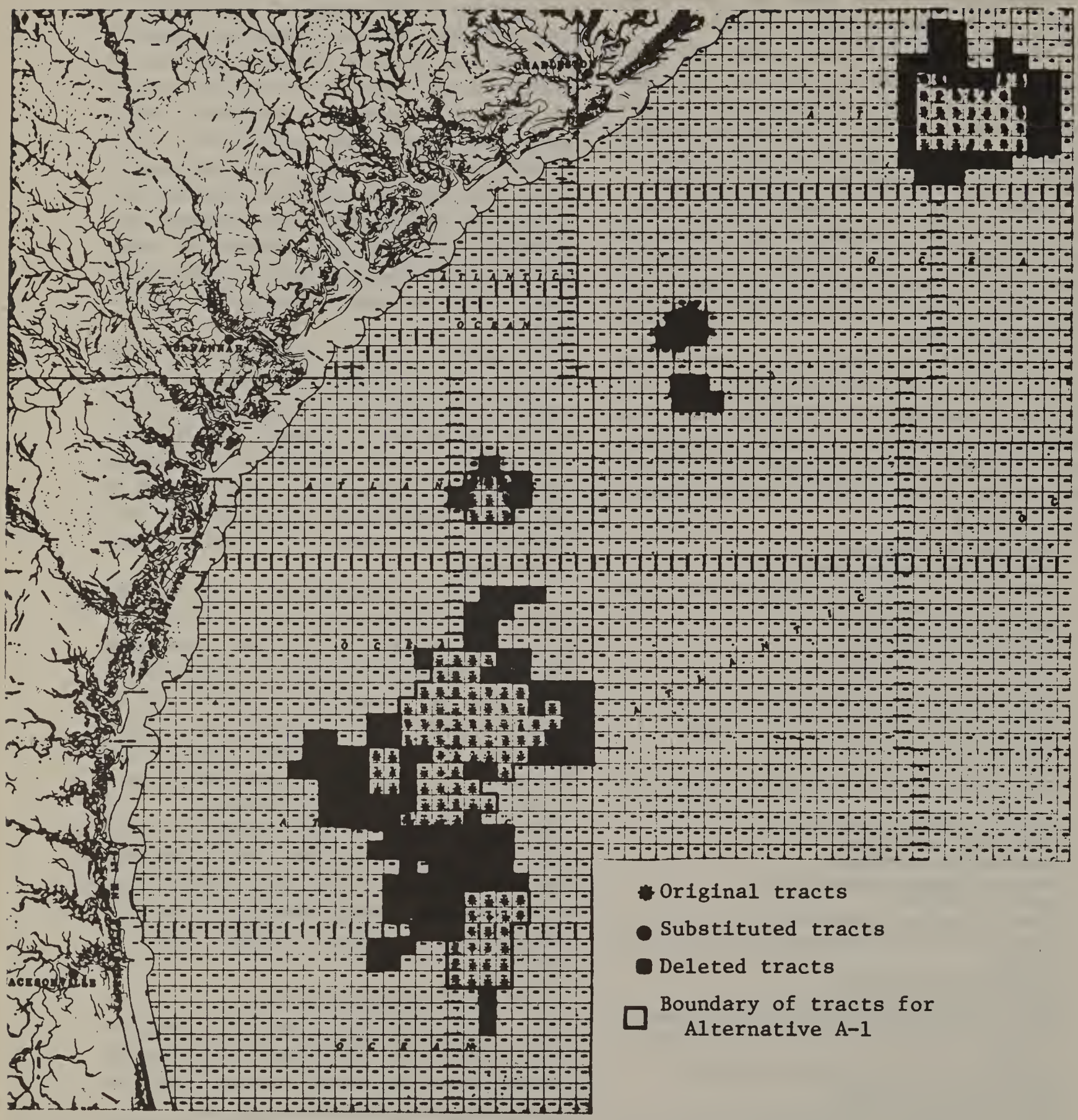


Figure VIII-1. Alternative A-1 substitution of tracts within the area of the Call for Nominations.

The cumulative impact of this and subsequent sales is believed to be about the same as discussed in the portion of the EIS concerned with the environmental impact of the proposed sale.

2. Substitution of alternate tracts for tracts located in reported and possible "Live Bottom" areas (Figure VIII-2).

"Live Bottoms" have been identified as a resource of concern. "Live Bottoms" are rock ledges supporting benthic epifauna and demersal and pelagic fish communities. While the actual extent of these communities is not known, a trend believed to contain these areas has been identified for the general area of proposed leasing for proposed Sale No. 43. This trend is based on information available to the New Orleans OCS Office concerning known live bottom areas, substrate type, and other environmental factors. Reference to Visual No. 4S shows tracts overlaid on live bottom areas.

Utilizing the resource groups identified for the Department of the Interior oil spill risk analysis model (Appendix M), the following groupings of tracts proposed for leasing in this sale fall within the live bottom trend and snapper bank areas.

Resource Area No. 1; 1-3, 6-14, 16-20, 22-25, 30-33, 37-41, 43-51
Resource Area No. 2; 52, 54, 55
Resource Area No. 4; 69-71, 74, 75, 77, 78, 80-82, 84, 85, 87-92, 95-101, 106-113, 120-126, 133-138, 149
Resource Area No. 5; 102-105, 114, 116-119, 127, 130-132, 139, 140, 143-145, 152-154
Resource Area No. 6; 146-149, 155-158, 162-166, 169-173, 175-177, 179-182, 184-186, 189-191, 196-198
Resource Area No. 7; 206-208, 213, 214
Resource Area No. 8; 183, 187, 188, 192-195, 199-205, 209-212, 215-225.

These reported or potential live bottom area tracts represent about 79 percent of all of the tracts proposed for leasing in this sale, or 177 tracts.

These live bottom areas, while possibly sensitive to disruption, may be a common feature of the South Atlantic OCS. However, because of the biological productivity of these communities, and because their extent has not been defined at this time, one alternative to the proposed sale would be to reduce by about one half the area proposed to be offered for sale which is identified as live bottom trend.

IMPACTS

Given the assumption that the possibilities for drilling operations, and hence impacts to live bottom areas, are equal for each tract, this option could reduce by approximately one half the impact of the proposed sale upon live bottoms; and therefore, lessen somewhat the impact upon the benthos and commercial fisheries.

The following tracts are proposed under this alternative for deletion (Figure VIII-2):

As hydrocarbon potential and industry interest were major criteria in the original tract selection process, it may be assumed that tracts not among the 225 tracts originally proposed for leasing may have not been chosen because industry interest and geologic and geophysical information indicated low hydrocarbon potential. Therefore, this alternative may result in lower production of oil and gas resources than would result from the original proposal.

Resource Area No. 1; 2, 3, 6-13, 16-19, 23-25, 45-51
Resource Area No. 2; 54
Resource Area No. 4; 69-75, 77, 88-90, 97, 101, 111-113, 124-126, 133-138, 149
Resource Area No. 5; 114, 139
Resource Area No. 6; 146-148, 158, 166, 182, 184-186, 189-191, 196-198
Resource Area No. 7; 206-208
Resource Area No. 8; 183, 187-188, 192-195, 199-202, 209, 215, 219, 223-225.

This alternative would substitute 80 tracts outside of the identified live bottom trend areas. These substitute tracts include the following (tracts are identified by protraction diagrams and their numbering system):

James Island NI 17-12; 205-207, 251, 295, 328, 339, 372, 382-383, 416, 424-427, 465-471, 509-515
Brunswick NH 17-2; 298, 386, 604-607, 647-651, 691-693, 735-737, 779, 780, 823, 824, 866, 867, 910
Jacksonville NI 17-5; 161, 162, 201, 204-206, 245-249, 289-292, 333-337, 377-381, 421-425, 465-469.

As many of the tracts seaward of the originally proposed tracts are also areas of live bottom trend, this alternative considers the leasing of a substantial number of tracts (57) closer to shore than does this original proposal. Increased risk of spills impacting shoreline resources may result with consequent impact on beaches.

To the extent that lower production occurs, oil and gas-related employment and local and regional incomes would increase by lesser amounts.

The cumulative effects that might result from the adoption of this alternative should not be greater than would occur with the proposal and should be less.

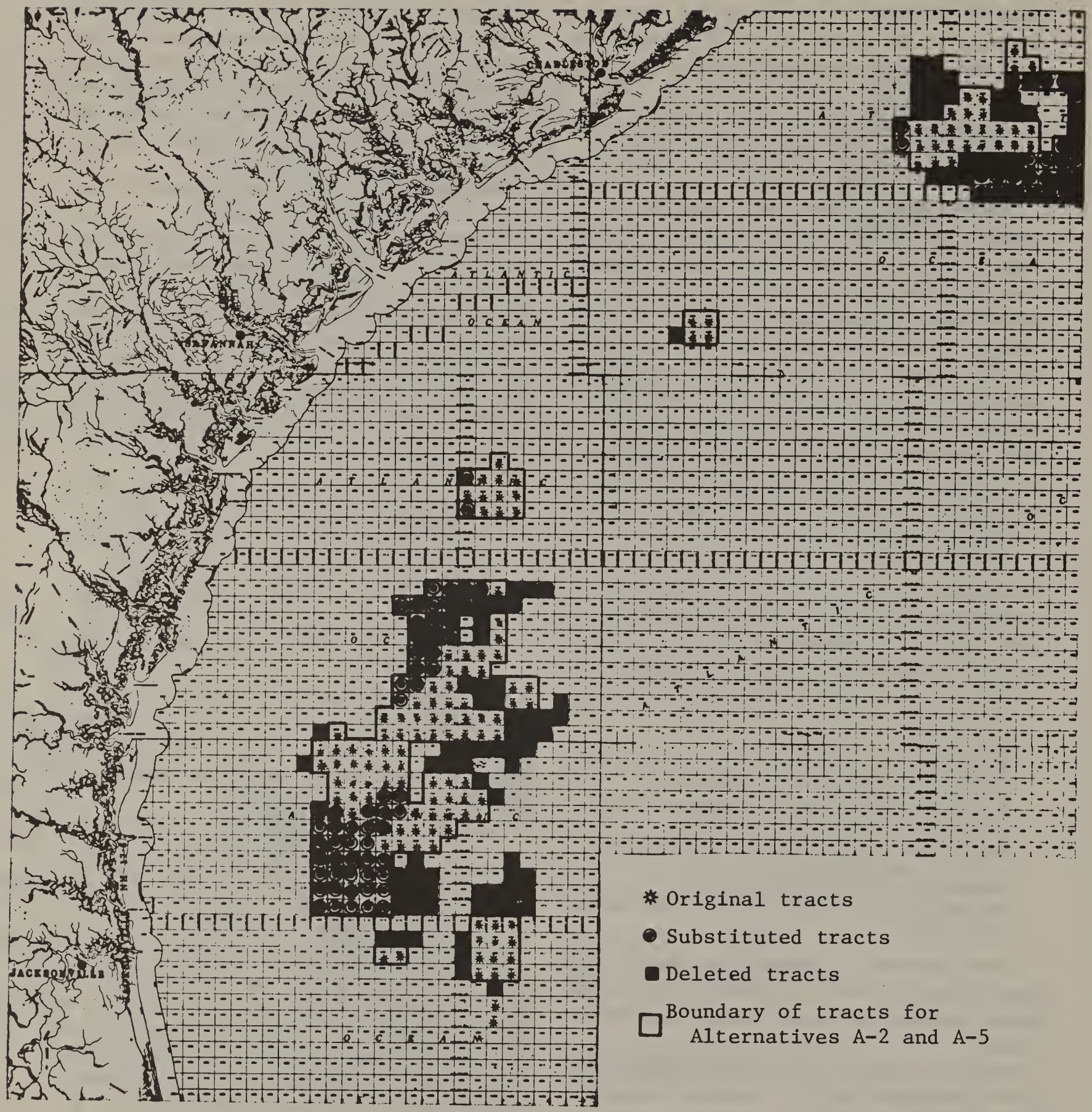


Figure VIII-2. Alternative A-2 substitution of alternative tracts for tracts located in reported and possible "live bottom" areas. Alternative A-5 delete tracts located within known and possible "live bottom" trends.

3. Substitution of new tracts for tracts located in reported "live bottom" areas (Figure VIII-3).

A resource of particular concern known as "live bottom" are rocky ledges supporting benthic epifauna such as anemones, hydroids, bryozoa and hard corals, as well as associated demersal and pelagic fish populations. While the actual extent of these systems is not known (their occurrence is thought to be discontinuous) a trend believed to contain these areas has been identified for the general area of proposed leasing for proposed Sale No. 43. This trend is based on information available to the New Orleans OCS Office concerning reported live bottom areas, substrate and other environmental factors. (Reference Visual). The following tracts (160) proposed for leasing in this sale fall within the live bottom trend identified: 1-3, 6-14, 16-20, 22-25, 30-33, 37-41, 43-52, 54-55, 69-71, 74-75, 77, 78, 80-82, 85, 87-92, 95-114, 116-127, 130-140, 143-149, 152-158, 162-166, 169-173, 175-177, 179-225.

These live bottom areas, while possibly sensitive to disruption, may be a common feature of the South Atlantic OCS. However, these communities are biologically very productive, and their extent is not defined at this time. One alternative to the proposed sale would be to reduce the area proposed to be leased which is identified as live bottom trend.

The matrix analysis of potential impacts on major resources and activities (Section III.F.) has assigned sensitivity values for oil spills and structures to various resources. For "live bottom" areas, this analysis assigned a rating of maximum potential impact to live bottom areas as a result of structure emplacement and operation. Sensitivity of live bottoms to oil spills was determined on the basis of water depths to which oil can be expected to be entrained in the water column. Table J-3 (Appendix J) indicates the results of the matrix analysis for live bottoms. Five tracts were identified as presenting maximum potential impact to live bottom and 52 tracts moderate potential impacts.

However, the matrix analysis assumed live bottom systems on all tracts. If these tracts are examined in relation to identified live bottom trend, it can be seen that no tracts identified as having maximum impact potential fall within live bottom trend areas. Twenty five tracts with moderate potential impact to live bottom systems do fall within live bottom trend areas. These tracts are: 2, 95, 96, 98-100, 106-110, 120-123, 127, 139, 140, 163-166, 171-173.

In addition, 25 tracts proposed for leasing are known live bottom areas. These are tracts: 3, 10, 12, 13, 16, 33, 40, 41, 43, 45, 46, 49, 69, 116-118, 130-132, 143-145, 203, 223, and 224. An alternative would consider substitution of 50 tracts not originally proposed for leasing. These 50 tracts, which are also outside of live bottom trend areas are (Figure VIII-3);

James Island NI 17-12; 207, 251, 295, 339, 383, 425-427, 465-471, 509-515.
Jacksonville NI 17-5; 161, 162, 204-206, 246-249, 290-292, 334-338, 378-381, 422-425, 467-469.

(Tracts are identified by protraction diagrams and their numbering system)

Twenty-eight of the tracts proposed for substitution lie immediately shoreward of production area 6 and south of production area 5, as defined in the Department's oil spill risk analysis. The other 22 tracts lie seaward of production area 1.

Production area 5, 6 and 1 are rated as second, fourth and fifth, respectively, out of eight areas in terms of risk on a per unit of oil production basis. Thus 28 of the tracts proposed under this alternative would add to the number of tracts relatively close to shore, thus possibly increasing the oil spill risk of the proposal.

IMPACTS

As hydrocarbon potential and industry interest were considered during the original tract selection process, it may be inferred that tracts not among those originally selected may not have been chosen because industry interest and geologic and geophysical information indicated low hydrocarbon potential. Then this alternative may result in lower production of oil and gas resources than would result from the original proposal.

To the extent that lower production occurs, lesser increases in oil and gas-related employment and resulting increases in local and regional income would result.

Impacts which would differ from the original proposal would be 1) a reduction in benefits of domestically and regionally produced petroleum resources, including employment and income as discussed above, 2) a reduced potential for impact to live bottom areas and therefore, the benthos and commercial fisheries, and 3) a possibility of a slightly higher risk of oil spills impacting shoreline resources, such as beaches.

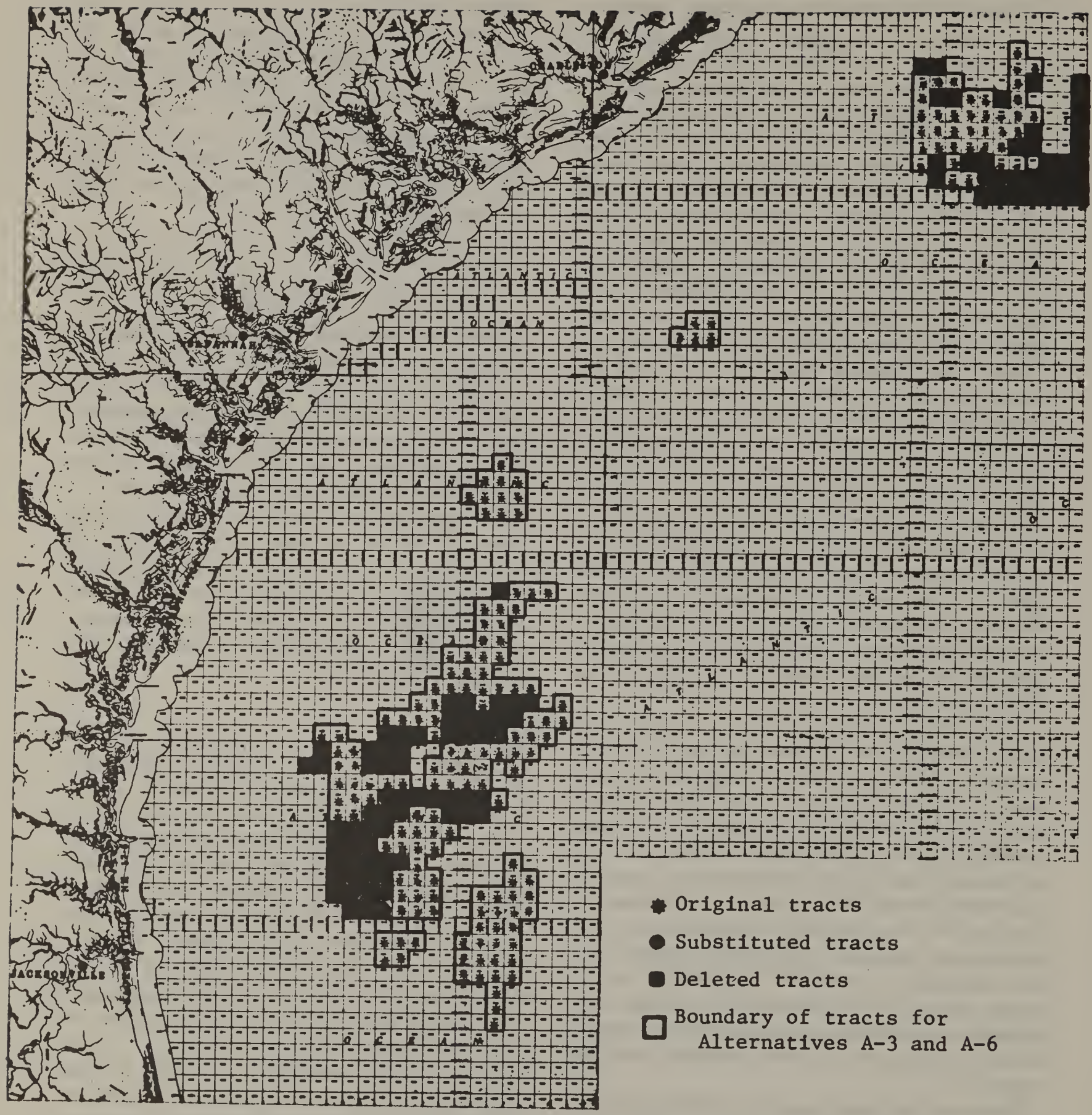


Figure VIII-3. Alternative A-3 substitution of tracts for tracts located in reported "live bottom" areas.
Alternative A-6 delete tracts located within known "live bottom" trends.

4. Delete tracts posing a relatively high potential of impacting biological and recreational resources (Figure VIII-4).

The Departments oil spill risk model was utilized to analyze spill risk for proposed Sale No. 43 (see Appendix M). Resulting from this analysis are rankings of relative risk among eight production areas. The rankings are given on the basis of risk per unit oil production (trajectories only as discussed above) and total risk over the estimated production life (taking into account resource potential as discussed above).

The analysis indicates that production areas 2 and 3 (tracts 52-56 and 57-67 respectively) rank among the three groups posing the highest risk of oil spills on a unit oil production basis. On the other hand, areas 2 and 3 rank seventh and fifth respectively when ranked by total risk. This would indicate that relative to the oil production potential of these production areas, their risk, in relation to other production areas, is high.

One alternative which could be considered would be to delete the 16 tracts which compose production areas 2 and 3 (Figure VIII-4). This alternative would reduce the proposed sale to 209 tracts, a seven percent reduction from the sale as originally proposed. It would also reduce by an undetermined amount the hydrocarbon expected to be produced as a result of the proposed sale. Since it would eliminate two scattered "production areas", exploration and any subsequent development would be limited to two major groups of tracts (that composed of production area 1 and that composed of production area 4-8). This would limit the areal extent of the South Georges Embayment which would be tested for oil and gas resources.

IMPACT OF THIS ALTERNATIVE

The adoption of the alternative would reduce the risk of environmental damage resulting from oil spills on 14 resource groups. The principal resources exposed to the highest probability of impact in the event of a spill are sandy beaches in Florida and North Carolina, the arctic peregrine falcon migration routes, some species of shrimp, and crabs and oysters. The reduction in acreage offered could result in the installation of 1 to 2 fewer platforms, the drilling of 18 to 50 fewer wells, and a reduction in the weight of drill cuttings ranging from 12,276 to 53,950 tons.

The adoption of this alternative would have the most significant cumulative impact on the arctic peregrine falcon. The migration route of the falcon passes along the coastal portions of the Atlantic Seaboard where additional OCS lease sales have been held or are being considered. The potential for the falcon to come into contact with spilled oil, either directly or indirectly, would be mitigated to some slight extent by the elimination of these tracts.

An incremental reduction in oil production could reduce the necessity for tanker transportation of crude petroleum to refining centers. In the event that crude petroleum was transported to refining centers receiving crude oil produced from the Mid Atlantic and North Atlantic OCS, an incremental reduction in tanker traffic, on the order of 1 voyage in a two week period, might result.

5. Delete tracts located within known and possible "live bottom" trends (Figure VIII-2).

In developing this alternative and identifying tracts for deletion, an effort was made to maintain groupings of tracts to protect "live bottom" areas and to provide for orderly development. Approximately half of the live bottom trend tracts in each previously identified resource area are deleted under this alternative. Based on the assumption of equal impact potential per tract, described above, this deletion scheme could halve the impact potential of the proposal relative to live bottom and at the same time retain those tracts which may be most prospective for oil and gas resources.

This alternative would delete 88 tracts of the 177 tracts identified within live bottom trend areas; and would reduce the proposed sale from 225 tracts to 137 tracts.

The reduction in the proposed sale size by approximately 39 percent could result in a proportional decrease in the amount of wells drilled, platforms installed, drilling muds, and formation waters utilized and produced, although this would depend on the hydrocarbon resources contained in the remaining 137 tracts.

The tracts proposed for deletion under this alternative include the following: Tracts 2, 3, 6-13, 16-19, 23-25, 45-51, 54, 69-75, 77, 88-90, 97, 101, 111-114, 124-126, 133-139, 146-149, 158, 166, 182-202, 206-209, 215, 219, 223-225.

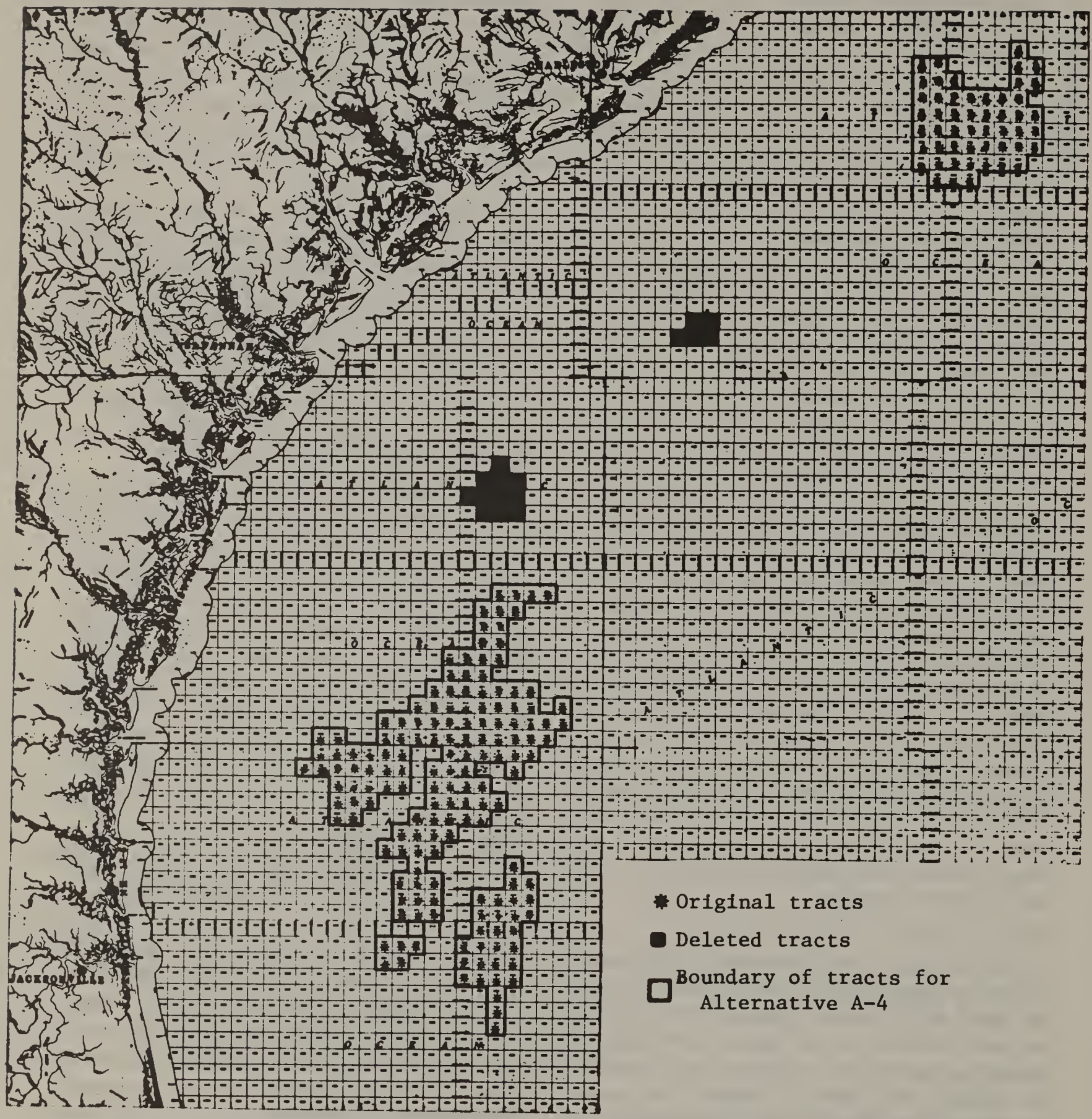


Figure VIII-4. Alternative A-4 delete tracts posing a relative high potential of impacting biological and recreational resources.

IMPACTS

Deletion of 88 tracts from the proposed sale would reduce the hydrocarbon potential of the proposed sale area by an undetermined amount. This alternative could be estimated to reduce the recoverable resources expected from the proposed sale to 180 to 650 million barrels of oil, and 1.2 to 4.4 trillion cubic feet of gas.

The reduced amount of exploration, development and production facilities required to develop hydrocarbon resources of the 137 tracts would result in lower increases in oil and gas-related employment and local and regional income than would be anticipated for the original sale proposal. However, as the distribution of remaining tracts would be approximately the same as that for the originally proposed leasing of 225 tracts, the distribution of onshore support facilities and services may remain similar to that expected for the originally proposed lease sale.

The reduction in size of the sale would also reduce the potential for accidental oil spills and could be expected to reduce low level chronic oil pollution. This, in combination with reduced numbers of wells, platforms, drill cuttings, drilling mud and formation waters could be expected to reduce the overall impact to marine organisms.

The principal reduction in tracts offered would be in Production Areas 1, 4, 6, 7, 8 and would reduce the amount of drill cuttings anticipated to result from the sale by 53,878 to 271,908 tons.

Since live bottom areas support populations of demersal and pelagic fishes, the deletion of half of the tracts within the identified live bottom trend could serve to reduce the impact on existing or future recreation and commercial fishing efforts by reducing the area and the number of offshore structures which could interfere with fishing in and around live bottom areas.

The probability of an oil spill in this area impacting a commercial fishing area is greater than 99.5 percent, and the deletion of tracts, by reducing the amounts of crude oil produced, could be expected to diminish the risk of interference with commercial fishing activity. In the event of a major spill, approximately 2 per cent of the commercial fishing area may be impacted.

The cumulative impacts associated with this alternative would be expected to be about the same as those discussed above.

6. Delete tracts located within known "live bottom" trends (Figure VIII-6).

The following 25 tracts were estimated to pose a moderate potential impact to live bottom systems. Tracts 2, 95, 96, 98-100, 106-110, 120-123, 127, 139, 140, 163-166, 171-173.

The following 25 tracts are located within known "live bottom" areas. Tracts 3, 10, 12, 13, 33, 40, 41, 43, 45, 46, 49, 69, 116-118, 130-132, 143-145, 203, 223-224.

Deleting this total of 50 tracts from the sale would provide a greater measure of protection to the known "live bottoms", and potential benefit to fishing activities and scientific investigation of the live bottom areas.

One alternative to the proposed sale would be to delete all tracts known to have live bottom systems and those tracts within the identified live bottom trend which have been identified as presenting moderate potential impact to live bottom systems as a result of potential oil spills.

This would result in deletion of 50 tracts from the proposed sale, reducing the size of the sale from the originally proposed 225 tracts to 175 tracts.

IMPACTS

This alternative of deletion of 50 of the tracts originally proposed for leasing could reduce by an undetermined amount the potential production of hydrocarbon resulting from the proposed sale. While several tracts proposed for deletion under this alternative are scattered throughout the proposed leasing area, two concentrations of tracts (163-166, 171-173 and especially 95, 96, 98-100, 106-110, 120-123) represent major groupings of tracts within the largest group of tracts proposed to be offered in proposed Sale 43.

With the exception of eight of these tracts (33, 40, 41, 45, 46, 49, 222 and 225) proposed under this alternative for deletion, these tracts are also identified in the matrix analysis as posing maximum risk to commercial and sport fishing as a result of structures and/or spills. Deletion of these tracts would, then, also afford reduced impact to fish populations and fishing efforts.

The reduction in the proposed sale size by approximately 22 percent could result in a proportional decrease in the amount of wells drilled, platforms installed and drilling muds, cutting and formation waters utilized or produced. Should the tracts deleted contain a substantially greater per-

centage of the resource estimated for the entire proposed sale area, a greater decrease in these facilities and activities would result. A reduction in the size of the sale would also reduce the potential for accidental oil spills and could be expected to reduce chronic low level oil pollution stemming from oil and gas operations. This would result in an overall reduction in the potential for impacts to marine organisms.

The reduction in the amount of exploration, development and production facilities which would be required to develop hydrocarbon resources of the 175 tracts would also reduce oil and gas-related employment increases which would otherwise be expected from proposed Sale 43. Increases in local and regional income would be reduced as well.

This alternative could be expected to result in production of less than the 0.282 to 1.009 billion barrels of oil and 1,890 to 6,810 trillion cubic feet of gas which is estimated to result from proposed Sale 43 as originally proposed. This would reduce those benefits which would stem from increased domestic production of petroleum. It would also reduce those benefits which could accrue to the region as a result of regionally produced petroleum resources.

Preliminary estimates indicate that total sale related employment may be less by approximately 350 to 1200 jobs in the event this alternative is chosen. The reduction in the amount of drill cuttings could amount to between 31,372 and 140,270 tons, and between 2 and 4 platforms would not be required.

In the event that these tracts were not offered at future sales, the cumulative impacts would be the same as the impacts relating to this alternative.

B. Delay the Proposed Sale

The proposed OCS Lease Sale No. 43 could be delayed from three to five years. If the proposed sale should be held at a later date, both geological hazards and any unique biological communities would have been identified and delineated. This data could be used for deletion of a tract or tracts prior to holding a sale. This alternative examines the assumption of delaying the proposed sale and its effects.

Coastal Zone Management Plans would probably be in effect in all of the coastal states. A delay in the proposed sale would provide additional time for environmental studies. If environmental studies were carried out during this period, notices to lessee, or changes in OCS Operating Orders could be developed and could be more specifically tailored to the U.S. South Atlantic OCS region so that during the production phase, regional oil and gas resources could be most advantageously exploited while also providing maximum protection to the environment.

In the event that leasing and exploration activities were being carried forward in other marine areas, both domestic and foreign, during the period of delay for proposed Sale No. 43, it is probable that at least some of the manpower and equipment would be used in exploration activities in these other areas. The provision of platforms, terminals, and pipelines required as a result of proposed OCS Sale No. 43 would also be delayed.

IMPACTS FROM THIS ALTERNATIVE

Delay of proposed OCS Sale No. 43 would result in the postponement of risk to alternative resource uses, particularly beaches, migration routes and commercial fishing, resulting from the exploration, production, and transportation of mineral resources that may be discovered as a result of proposed Sale No. 43. Delay of the proposed sale would not result in the postponement, or delay, of all risk to alternative resource uses in the area, since the existing energy needs within the area are partially met by the water transportation of petroleum products, and to the extent that this marine traffic continues, the risk of oil spills would be present from this source.

During the initial years of exploration and production activity, crude oil produced from these leases would probably be shipped by tanker to refineries located in other parts of the nation, and this traffic would be an addition to the marine transportation of petroleum products into the region. Delay of the sale would eliminate the incremental risk of oil spill damage due to the production and transportation of crude oil. The postponement of the sale would delay the placement of structures, pipelines, and terminals, and eliminate the impact of these facilities during the period of delay.

The cumulative impacts associated with a delay of proposed Sale 43 would be partially dependent on the results of the initial exploratory drilling.

Since proposed OCS Sale No. 43 is the initial sale on the South Atlantic OCS, a delay in this proposed lease offering may have an effect on subsequent offerings, and development related to these possible subsequent offerings.

The estimate crude oil production that may result from OCS Sale No. 43 amounts to between 56,000 and 170,000 barrels of oil per day. During October, 1976, the refiner acquisition cost of imported crude petroleum was estimated to be $13.47 per barrel by the Federal Energy Administration, indicating a cost approximately $2.00 per barrel above the cost of new domestic crude oil production. Delay of the proposed sale, therefore, implies an additional economic cost of $124 million per year for the use of more expensive imported crude oil during the period of delay.

C. Withdraw the Proposed Sale

Another option is to cancel the proposed sale. This option would reduce future OCS oil and gas production and would thus necessitate continuing foreign imports or reducing energy consumption by reduced demand or supply shortfalls, or developing alternative energy sources, or some combination of these.

The prices of oil and gas have recently undergone significant increases. The price of oil has been increased by the effects of the oil embargo of 1973 and the subsequent passage in 1975 of the Energy Policy and Conservation Act with subsequent amendments being enacted in 1976. These price increases should encourage the domestic production of oil and gas while somewhat dampening the consumption of oil and gas. The effect of these price increases is to make the cost of oil and gas more expensive relative to the costs of other energy sources.

The Southeastern U.S. has a limited overall petroleum resource base and has historically been dependent upon other regions for the raw materials needed to meet much of its energy needs. Energy costs in the Southeastern U.S. have been higher due in part to the transportation costs needed to bring petroleum products to the area. Should the proposed sale be withdrawn, the Southeastern U.S. continue to experience above average energy costs. Should the sale be held and recoverable amounts of oil and gas be found, the Southeastern U.S. could still be expected to experience a moderation in energy costs although possibly to a slight degree.

It is anticipated that the oil and gas that would become available from this proposal in the next 20-year period could provide significant contribution to this region's energy supply, or if the subject sale were cancelled, the following energy actions or sources might be used as substitutes.

- Energy conservation
- Conventional oil and gas supplies
- Coal
- Nuclear power
- Oil shale
- Hydroelectric power
- Solar energy
- Energy imports
  - Oil imports
  - Natural gas pipeline imports
  - Liquefied natural gas imports
- Geothermal energy
- Other energy sources
- Combination of alternatives

This section briefly discusses these alternatives. For more detailed information on each of these energy sources and environmental impacts, refer to the study *Energy Alternatives: A Comparative Analysis*, prepared for the Bureau of Land Management by the Science and Public Policy Program of the University of Oklahoma. Copies of this study (stock number 641–011–00025–4) may be purchased for $7.45 from the Superintendent of Documents, U.S. Government Printing Office (GPO), Washington, D.C. 20402.

1. Energy Conservation

A. DESCRIPTION

Vigorous energy conservation is an alternative that warrants serious consideration. The Project Independence Report of the Federal Energy Administration claims that energy conservation alone can reduce energy demand growth by 0.7 to 1.2 percent depending on the world price of oil. Aside from these savings, it is now widely recognized that wasteful consumption habits impose social costs that can no longer be afforded.

The residential and commercial sectors of the economy are often characterized as inefficient energy consumers. Inadequate insulation, inefficient heating and cooling systems, poorly designed appliances, and excessive lighting are often noticed in these sectors. Reductions in consumption beyond those induced by fuel price increases could be achieved by new standards on products and building, and/or subsidies and incentives. Such incentives include standards for improved thermal efficiency in existing homes and offices and minimum thermal standards for new homes and offices.

Excessive consumption is also evident in the industrial sector where energy inefficient work schedules, poorly maintained equipment, use of equipment with extremely low heat transfer efficiencies, and failure to recycle heat and waste materials are all commonplace. Estimated energy savings of between 10 and 30% may be available in this sector of the economy.

Transportation of people and goods accounts for approximately 25% of nationwide energy use. Energy inefficiency in the transportation sector varies directly with automobile usage. Automobiles, which account for 90% of all passenger movement in the nation, use more than twice as much energy per passenger mile as buses. Moreover, the average car carries only 1.3 pas-

sengers. Using short- and mid-term conservation measures such as consumer education, lower speed limits, rate and service improvements on public transit and rail freight transit, energy savings of 15 to 25% might be achieved.

Other policies which could encourage fuel conservation in transportation include standards for more efficient new autos and incentives to reduce miles traveled. An important new development in the fuel economy area could be the modification of the standard internal combustion engine. Although such an engine is now in the advanced stages of development, further study by automotive engineers, industry, and concerned federal agencies is necessary before an acceptable engine may be developed.

Significant energy savings are clearly possible through accelerated conservation efforts. The Project Indenpendence Report estimates that conservation alone could result in a 2.2 million barrel per day reduction in petroluem demand by 1985. These savings will be necessary in order to achieve the goals of energy self-sufficiency. In addition, several of the strategies mentioned above have been at least partially implemented by the Energy Policy and Conservation Act of 1975 (P.L. 94-163).

B. ENVIRONMENTAL IMPACTS

The environmental impacts of a vigorous energy conservation program will be primarily beneficial. The exact nature and magnitude of these impacts will depend on whether there is a net reduction in energy use or whether the reduction is accomplished through technological change and substitutions. For the former, the net impacts will simply be that there are fewer pollutants of all kinds unleashed. As an example, the 2.2 million barrel per day savings by 1985 mentioned above would result in a diminishment nationwide of various pollutants by the following amounts. (HUD Contract #H2026R).

CO—4 lbs./1000 gals = 189 tons/day

Hydrocarbons—3 lbs./1000 gals = 142 tons/day

Particulates—23 lbs./1000 gals = 1088 tons/day

NO_x—60 lbs./1000 gals = 2838 tons/day

SO_2—157 lbs./1000 gals = 7426 tons/day

However, if energy conservation is achieved by technological change or substitution, the net reductions will be those above, less the incremental pollutants from other sources, as well as any new pollutants which might arise from these other sources.

2. Conventional Oil and Gas Supplies

A. DESCRIPTION

Large quantities of oil and gas still remain in the United States. The U.S. Geological Survey estimates that onshore crude oil measured reserves as of December 31, 1974, were about 37 billion barrels, indicated reserves were 4.33 billion barrels, inferred reserves were 20.4 billion barrels, and undiscovered recoverable resources ranged from 37 billion barrels with a 95% probability to 81 billion barrels with a 5% probability.

Despite the magnitude of reserves, domestic oil production is likely to continue to decline from its peak production rate attained in 1970. All of the twelve oil production forecasts discussed in the Project Independence Blueprint claimed that, in the next few years, the U.S. petroleum production decline would continue. Most of these same forecasts predict increasing domestic production by the late 1970's, but only under the most favorable conditions in terms of prices, development of OCS resources, regulations, and environmental constraints.

The development of new reserves required to meet gas demand will depend on continued development of onshore areas and of commercially viable muclear stimulation or massive hydraulic fracturing to produce natural gas from low permeability reservoirs. Additional domestic oil reserves are recoverable through secondary and tertiary extraction techniques. However, the additional oil that is attainable in this manner is many cases "old" and hence has been subject to price controls. These controls have diminished the incentive for using these sophisticated and expensive recovery methods, although continued consideration is being given to the level of incentive required.

One study of future natural gas production rates concluded that the upper production limits of natural gas are now being approached. (Duane and Karnitz, 1975). Two constraints are indentified: the level of recoverable resources, and the production level that can be sustained for a reasonable time period. Once assumptions of these two levels are made, there is not much room for variations in the maximum potentially attainable production rate. Assuming the current

Potential Gas Committee's estimate of recoverable domestic natural gas resources (1845 tcf for the U.S. including Alaska), the study considers two possible levels of natural gas production: 25 to 30 tcf/year under optimistic conditions, and 20-25 tcf/year under less optimistic conditions.

A detailed description of the crude oil and natural gas systems is found in Chapters 3 and 4 of *Energy Alternatives: A Comparative Analysis.*

To substitute directly for the subject sale, a combination of onshore and OCS production from other areas and continued foreign imports would be required to make up for the estimated total production of this proposed sale of 0.28 to 1.0 billion barrels of oil and 1.9 to 6.8 trillion cubic feet of gas, over a 20-year period.

b. Environmental Impact

This substitution would entail environmental impacts such as land subsidence, soil sterilization, and disruption to existing land use patterns. Equipment failure, human error, and blowouts may also impair environmental quality. Moreover, poor well construction, particularly in older wells, and oil spills can result in ground and surface water pollution.

The magnitude of these impacts would depend on whether the increased production resulted from improved recovery methods or new discoveries. If improved recovery is realized, the impacts will likely be of little significance and will occur in already developed areas. Should new discoveries be found, the impacts will be more significant and disruptive, as the whole new infrastructure would have to be built from the ground up.

The water pollutants from onshore oil production are oil and dissolved solids. The amounts of each vary over a wide range. A summary of this is available in *Energy Alternatives: A Comparative Analysis.*

Air pollutants (particulates, NO_x, SO_x, hydrocarbons and CO) result from blowouts and subsequent evaporation and burning. These are generally insignificant, except locally. These effects will be basically the same, whether the production is on or offshore.

Given the fact that onshore supplies are dwindling, the South Atlantic States would have to continue their reliance on other regions and foreign imports for needed oil and gas. The decline in these supplies, even with energy conservation, could mean further unemployment, higher consumer prices, and changes in standard of living. The lack of natural gas will mean additional use of "dirtier" alternative fuels (oil, coal) with consequent impacts on air quality and human health.

3. Coal

a. Description

Coal is the most abundant energy resource in the U.S. Coal deposits underlying nearly 460,000 square miles in 37 States constitute one-quarter of the known world supply and account for 80% of our proven fuel reserves. Proved reserves of coal contain 125 times the energy consumed in 1970. A detailed discussion of the coal resource system can be found in Chapter 1 of *Energy Alternatives: A Comparative Analysis.*

To replace the energy expected to be realized from the proposed South Atlantic sale, 6 to 21 million tons of coal per year would be necessary. Though domestic reserves could easily provide this quantity, serious limitations to coal development exist. Although power generated by water and coal is an important component in the energy supply pattern of the Southeastern U.S., in many uses, coal is an imperfect substitute for oil or natural gas. In many other cases, coal use and production is restricted by government constraints, limited availability of low sulfur deposits, inadequate mining, conversion, and pollution abatement technology, and the hazardous environmental impacts associated with coal extraction and electricity generated from coal. Coal production is also threatened by the unique set of labor problems associated with mining and new strict standards for coal mine safety.

Although U.S. coal resources are very large, as with other extractable mineral fuels, there is some geographic dislocation. Most of our coal is found west of the Mississippi River far from the industrial areas of the South Atlantic. The Eastern Province contains only 9% of the total estimated domestic coal resources. However, it contains 80% of the remaining identified high-rank bituminous coal. Also, much of the western coal is in arid or semi-arid areas where scarcity of water could constrain development.

The portion of the demonstrated reserve base that is available for use depends on whether the coal deposit can legally be mined, and if it can, whether it is suited for underground or surface mining. Surface mines may recover up to 90% of

the coal in a given mine; underground mines may recover 50 to 60 percent using room and pillar methods. Both underground and exposed coal deposits are found in the Eastern province. However, statistics indicate that at the 1972 price only 12% of the total resource could be considered economically recoverable. As with other extractable hydrocarbons, the quantity of available coal is a function of coal's market price. Current increases in the market price for coal are making more of this resource base available for domestic consumption.

If an alternative to proposed OCS Sale No. 43 is greater reliance on coal, it may be expected that mining would increase in either the eastern (dependent on acceptability of high sulfur coal) or western states to provide the necessary fuel source. The closest area of known coal reserves to the Southeastern U.S. region is Alabama.

Current estimates for development of coal resources indicate approximately 5 years would be necessary for opening a new coal mine (BLM 1975). If electric generation were to take place at the mine site, approximately 8 years lead time would be necessary. Due to existing air quality in the region, it is unlikely that such a coal burning facility would be allowed under present EPA standards unless waivers are granted or technology could keep particulate emissions at acceptable levels. Synthetic gas production would take a maximum of 10 years from lease issuance to gas delivery.

B. ENVIRONMENTAL IMPACT

Coal Utilization

Combustion of coal results in various emissions, notably SO_2 and particulates. If the expected production from this sale is replaced by coal, there will be an increase in these pollutants, especially if coal is substituted for the natural gas presently used. Technology to control these emissions is available but has not yet been proven sufficiently to be widely applied. The sulfur content of eastern coal varies considerably but approximately 65% of the developed resources have a sulfur content exceeding 1%. Most of the U.S. low sulfur coal is located in the western states, far from major markets in the South Atlantic area. Any large scale shift to coal would require relaxation of emission regulations or improvement of technologies to convert coal to gaseous or liquid fuels.

Surface Mining

The 6 to 21 million tons per year of coal that would be necessary to replace production from this proposed sale would require up to four large open-pit miles (assuming 5×10^6 tons annually each). The primary impact of surface mining is disruption of the land. This affects all local flora and fauna, water quality, and increases landscape problems due to erosion and runoff from the mines. Reclamation is difficult in the western states due to the lack of water to assist in revegetation. Other problems include acid mine water drainage, leachings from spoil piles, processing waste, and the disturbance caused by access and transportation. Noise and vibration resulting from operations can also be expected. Finally, surface mining causes conflicts with other resources uses (agriculture, recreation, water, wildlife habitat, as examples).

The land use of strip-mining ranges from 0.18 to 519 acres/10^{12} BTU extracted, depending on seam thickness and Btu content of the coal. Assuming a ball park figure of two acres/10^{12} BTU, the annual surface disturbance to substitute coal for oil and gas from this proposed lease sale could range from 269 to 993 acres. Hence this disturbance is incremental, the total impact, assuming a 25-year field life, could be as much as 18 to 69 square miles per year.

Underground Mining

To replace the expected production from this proposed South Atlantic sale, from 3 to 9 underground mines would be required (assuming 2×10^6 annual tons each). Underground mining primarily affects land and water quality. The land impacts are those that arise from subsidence, waste disposal, and access and transportation. Very little surface is disturbed. Subsidence can destroy structures, cause landslides and earthquakes, and disrupt groundwater circulation patterns. The amount of subsidence can be controlled by mining method used and the amount of coal removed. Both have detrimental effects on the economics of the operation.

Water quality is affected by both processing waste and the drainage of acid mine-water into surrounding areas. These can be minimized through the proper methods of control both during and after operations. Entrances can be sealed, waste piles can be replaced in the mine. This would also help minimize subsidence. Also, there

are pollution problems associated with road and coal dust and the like, but these are minimal and easily controlled. Other disturbing aspects of mining have much less of an impact in an underground than a surface mine. Working conditions of underground mines have been improved under the Federal Coal Mining Health and Safety Act of 1969, although further efforts are needed to reduce health hazards. This program has resulted in increasing costs of underground mining relative to surface mining, which has even more severe environmental restraints and impacts.

Coal Transportation

The five major transportation systems (road, rail, water, conveyor, and pipeline) all have some adverse environmental impacts. These include air and noise pollution, safety, land use, trash, disposal, and aesthetics. However, since spill problems are not associated with coal, most of the impacts can be controlled with greater care and consideration. A slurry pipeline also requires large supplies of water and must adequately dispose of this at the other end. Water availability is a problem in many areas of the U.S., especially in the west where energy resource requirements will have to compete with other existing commercial and private users for a limited and fragile supply. Construction of such slurry pipelines over long distance to the South Atlantic area from the coal-abundant States would involve extensive costs that may not be economically feasible for many years yet to come.

Coal Conversion

Technology for conversion of coal into gaseous and liquid hydrocarbons has been established for several decades and a number of relatively low-capacity commercial plants exists in various parts of the world. However, few cost-effective advanced technologies have progressed beyond the pilot plant stage.

Numerous problems remain before commercial development of synthetic fuels from coal can proceed. Specific technical problems must be solved. The cost effectiveness of synthetic fuels from coal will depend on prices of other fuels, primarily oil and natural gas.

Control of adverse environmental effects will increase the cost of producing synfuels. Possible constraints on development include technological constraints; availability of skilled workers, raw materials (coal, water, steel), capital; and institutional constraints; Government policies (energy resource leasing, coal mining regulations, permit procedures, etc.), and the willingness of industry to invest in development of new technologies. Present prices for synthetic natural gas are $5.35 per thousand cubic feet versus about $3.00 for conventional natural gas at the burner tip in the Southeastern U.S.

Synthetic oil and gas could contribute substantially to energy supplies by the year 2000—up to 14% according to the Synfuels Interagency Task Force (Report to the President's Energy Resources Council, November 1975). However, the most important contributors would be high-Btu gas for coal, and synthetic crude oil from oil shales. Prospects from coal liquefication and low-Btu gas appear less attractive. The success of these energy sources will depend on developing technology, the cost of the impacts, especially coal, and the cost of conventional oil and gas.

Coal Gasification

Gaseous fuels with low, intermediate, or high energy content can be produced. Low and intermediate gases are produced in a two-stage process involving preparation and gasification, and the output is utilized as feedstock for electric generators. A third process, upgrading, is required to produce high-Btu gas, which produces an end product useable by the consumer.

Among low-Btu gasification processes under development are: Lurgi, Koppers-Totzek (both in commercial use), Bureau of Mines Stirred Fixed Bed, and Westinghouse Fluidized Bed. Among High Btu-gasification processes are: Lurgi high-Btu gasification process, HYGAS, BI-Gas, Synthane, and CO_2 Acceptor.

The environmental impacts of coal gasification are those of mining plus those resulting from the production processing. Gasification processes have lower primary efficiency than direct coal combustion; more coal will have to be gasified to reach an equivalent Btu output. However, it is likely that coal gasification will achieve primary efficiencies of 70%, which is about twice that of coal to electricity end use (Hale, 1975). Water impacts of processing can be minimized by recycling and evaporation. However, large inputs of water are required for some of the technologies, thus creating the potential for conflicts in water-short areas. For example, a Koppers-Totzek gasifier producing 250 10^9 Btu per day will require water

in the amount of 463,000 gallons per day and coal in the amount of 10,570 tons per day. To substitute for this proposed sale, from two to five complexes would require from .09 to 2.3 million gallons of water per day and 9.8 to 26.0 million tons of coal per year. The land use required for these plants, if they were to be located in the South Atlantic region, based on 330 acres per plant, would be from 660 to nearly 1,650 acres.

Air pollution could include sulfur dioxide, particulates, nitrous oxides, hydrocarbons, and carbon monoxides.

Land impacts result from solid waste disposal plus the land use for plant, coal storage, cooling sands, etc. Solid wastes include ash, sulfur and minute quantities of some radioactive isotopes.

Coal Liquefaction

As with coal gasification, production of liquid fuels from coal requires either addition of hydrogen or removal of carbon from the compounds in the coal. Coal liquefaction can be viewed as a change in the carbon to hydrogen ratio that can be accomplished by one of these reactions: hydrogenation, pyrolysis, or catalytic conversion. Of these, only the last is the commercial operation. Among liquefaction processes under development are: Synthoil, H-Coal, Solvent Refined Coal, Consol Synthetic Fuel, COED, TOSCOAL, and Fischer-Tropsch.

Again, the impacts of liquefaction will be those of mining and those of the processing plants. The available technologies have a recovery of from 0.5 to 3 barrels of oil per ton of coal processed.

Water effluents from liquefaction plants could contain amounts of phenols, solids, oil, ammonia, phosphates, and others. The waste water could be treated to remove most of these.

Air pollution could result from particulates, nitrogen and sulfur oxides, and other gases. Pollution control facilities would be required, but would lower the economic attractiveness of the plants.

Solid wastes would be mostly ash. Residue could be buried in the mine with little further environmental impact, if liquefaction plants are sited at the mine mouth.

Impacts from this alternative would probably be absorbed by States other than those on the South Atlantic coast.

4. Nuclear Power

A. DESCRIPTION

The predominant nuclear system used in the U.S. is the uranium dioxide fueled, light water moderated and cooled nuclear powerplant. Research and development is being directed toward other types of reactors, notably the breeder reactor and fusion reactors.

As of December 31, 1975, 56 nuclear plants with capacity of 37,500 NW were licensed to operate. At the end of 1975, nuclear power generated about 8% of the nation's electricity. However, about half of the electric power capacity now under construction is nuclear powered. Nuclear power development has encountered delays in licensing and siting, environmental constraints, and manufacturing and technical problems. Future capacity will be influenced by the availability of plant sites, plant licensing considerations, environmental factors, nuclear fuel costs, rate of development of the breader and fusion reactors, and capital costs. In order to meet future uranium fuel requirements, it will be necessary to locate additional ore reserves through increased exploratory drilling activity.

Fuel cycle costs of nuclear reactors have increased only slightly since 1965, from a range of about 17 cents to 22 cents per million Btu, to about 30 cents in 1974. Present trends in reactor capital costs are significantly narrowing the economic advantage offered by fuel cycle costs, over coal and oil-fired plants.

B. ENVIRONMENTAL IMPACT

Although nuclear plants do not emit particulates or gaseous pollutants from combustion, the potential for serious environmental problems exists. Some airborne and liquid radioactive materials are released to the environment during normal operation. The amounts released are very small and potential exposure has been shown to be less than the average level of natural radiation exposure. The plants are designed and operated in such a way that the probability of harmful radioactivity released from accidents is very low.

Nuclear plants use essentially the same cooling process as fossil-fuel plants and thus share the problem of heat dissipation from cooling water. However, light water reactors require larger amounts of cooling water and discharge greater amounts of waste heat to the water than comparably sized fossil-fuel plants. The effects of

thermal discharges may be beneficial in some though not all cases. Adverse effects can often be mitigated by use of cooling towers.

Low level radioactive wastes from normal operation of a nuclear plant must be collected, placed in protective containers, and shipped to a Federally-licensed storage site. High level wastes created within the fuel elements remain there until the fuel element is processed. Currently, spent fuel is stored at NRC-licensed facilities. Plans call for recovering unused fuels at reprocessing plants, solidifying the wastes, and placing them in storage at a Federal Repository.

Primary residuals from light water reactors are waste heat and radioactive emissions. For a 1000 NW(e) plant operating at a 75% load factor, a 33% efficient nuclear plant would emit 47 x 10^{12} Btu's of waste heat annually. For comparison, a 40% efficient fossil fuel plant would emit 36 x 10^{12} Btu's of waste heat.

To substitute for this proposed sale, it would take from two to five 1000 NW(e) light water reactors to supply the equivalent energy, assuming 40% plant efficiency and 80% loading. First core loading of these plants would require from 60 to 150 tons of enriched uranium (U_3O_8), with annual reloadings requiring from 20 to 50 tons total. This kind of substitution assumes that all oil and gas produced from this sale would generate electricity. Nationally, only 8% of oil and 18% of gas consumed is utilized to generate energy.

There are also the impacts on land, water, and air quality arising from the mining of these uranium ores. Dwindling amounts of high grade reserves will increase the amounts of land mined for lower grade radioactive ores—primarily in western states. The mining operations will be similar to coal, but the nature and distribution of the deposits mean "lesser" impact while radioactive tailings cause unusual problems for disposal, the environment, and human health.

A more complete discussion of uranium mining and processing, their economics and environmental impacts, and nuclear fission and fusion can be found in Chapters 6 and 7 of *Energy Alternatives: A Comparative Analysis.*

5. Oil Shale

a. DESCRIPTION

Large areas of the United States are known to contain oil shale deposits but those in the Green River formation in Colorado, Wyoming, and Utah, have the greatest commercial potential.

The oil shale resources of the Green River formation are estimated at 1,781 billion barrels, of which 129 billion barrels are classes one and two resources, 186 billion barrels are class three resources, and 1,466 billion barrels are class four resources (National Petroleum Council, 1972).

To substitute the energy equivalent estimated to be produced from this proposed sale, from 0.86 to 3.27 billion tons of oil shale would have to be mined and processed, i.e., from 93,900 to 360,100 tons per day.

b. ENVIRONMENTAL IMPACT

Oil shale development poses serious environmental problems. With surface or conventional underground mining, it is very difficult to dispose of the huge quantities of spent shale, which occupy a larger volume than before the oil was extracted. Inducing revegetation in an area of oil shale development is difficult and may take more than ten years. In-place processing avoids many of these environmental hazards. The spent shale problem is much less severe with underground mining.

Air pollutants from the mining will come from dust and vehicular traffic. These will be predominantly particulates, followed by NO_x and CO, with minimal amounts of hydrocarbons SO_x, and aldehydes.

The mining of oil shale requires little water, both for operations and for reclaiming solid wastes. Water pollutants are considered negligible but may arise if saline water were encountered during the operations and had to be disposed of.

However, the processing (retorting) operations consume large quantities of water and generate large amounts of waste water. The waste water must be treated and can be reused in the processes. Therefore, it has been assumed that water pollution will not be a problem outside the complex. However, the limited availability of input water in the development area could lead to resource use conflicts.

Air pollutants vary with the technology used. Solid waste comprises the greatest problem of oil shale processing. The volume of the waste is greater than the volume of the input. Therefore, backfilling and the like would not provide a sufficient disposal space. Finally, there are the impacts of access and of transporting the products. These are analogous to those of coal mining in the case of access, and petroleum distribution in the case of transporting the product.

A fuller description of this energy sources can be found in Chapter 2 of *Energy Alternatives: A Comparative Analysis.*

6. Hydroelectric Power

A. DESCRIPTION

Hydropower is energy from falling water, which is used to drive turbines and thus produce electricity. Conventional hydroelectric developments convert the energy of natural regulated stream flows falling from a height to produce electric power. Pumped storage projects generate electric power by releasing water from an upper to a lower storage pool and then pumping the water back to the upper pool for repeated use. A pumped storage project consumes more energy than it generates but converts offpeak, low value energy to high value peak energy. A more detailed discussion of this energy source is found in Chapter 9 of the study *Energy Alternatives: A Comparative Analysis.*

Many of the major hydroelectric sites operating today were developed in the early 1950's. Thirty to forty years ago hydroelectric plants supplied as much as 30% of the electricity produced in the U.S. Although hydroplant production has steadily increased, thermal-electric plant production has increased at a faster rate.

As of May 1974, total conventional hydropower developed in the contiguous U.S. was 54,885 MW, nearly one half of which was in the western states of Washington, Oregon, and California. Some 6878 NW of conventional hydro capacity are now being installed, about 90% of which is in the western part of the country.

Much of recent hydroelectric development has been pumped storage capacity. As of May 1974, the total developed pumped storage capacity in the contiguous U.S. was 8119 MW; capacity under construction was 6253 MW.

The undeveloped potential for hydroelectric generation is about 93,000 MW in the lower 48 states and about 32,000 MW in Alaska. However, it is likely that hydroelectric power will continue to represent a declining percentage of the total U.S. energy mix due to the following: high capital costs, seasonal variations in waterflows, land use conflicts, environmental effects, water use, and flood control constraints. Sites with the greatest production capacity and lowest development costs have already been exploited.

B. ENVIRONMENTAL IMPACT

Construction of a hydroelectric dam represents an irreversible commitment of the land resource beneath the dam and lake. Flooding eliminates wildlife habitat and prevents other uses such as agriculture, mining, an free-flowing river recreation.

Hydroelectric projects do not consume fuel and do not cause air pollution. However, use of streams for power may displace recreational and other uses. Water released from reservoirs during summer months may change ambient water temperatures and lower the oxygen content of the river downstream, adversely affecting indigenous fish. Fluctuating reservoir releases during peak load operation may also adversely affect fisheries and downstream recreation. Screens placed over turbines prevent the entrance of fish, but small organisms may pass through and may be killed.

Fish may die from nitrogen supersaturation, which results at a dam when excess water escapes from the draining reservoir. High nitrogen levels in the Columbia and Snake Rivers pose a threat to the salmon and steelhead resources of these rivers. Other adverse impacts to water quality include possible saline water intrusion into waterways and decreased ability of the waters to accommodate waste discharges.

Air quality will only be affected by dust and emissions during the construction phase. Afterwards, if the impoundment is used for recreation, motor exhausts would occur.

Land, other than that inundated, would be disturbed by support facilities, roads and transmission line rights-of-way.

7. Solar Energy

A. DESCRIPTION

Applications of solar energy must take into account the following:

- Solar energy is a diffuse, low intensity source.
- Its intensity is continuously variable with time of day, weather, and season.
- Its availability differs widely between geographic areas.

Potential applications of solar energy show a wide range. Among them are:

- Thermal energy for buildings
  - Water heating, space heating, space cooling combined systems
- Renewable clean fuel sources
  - Combustion of organic matter
  - Bioconversion of organic materials to methane
  - Pyrolysis of organic materials to gas, liquid, and solid fuels
  - Chemical reduction of organic materials to oil

Electric power generation
Thermal conversion
Photovoltaic—residential/commercial, ground central station, space central station
Wind energy conversion
Ocean thermal difference

Because of the energy situation, congressional interest in solar energy research has intensified. The Solar Heating and Cooling Demonstration Act of 1974 legislates a $60 million demonstration program aimed at proving the commercial feasibility of solar heating of buildings and homes by 1977 and of combined solar heating and cooling systems for those constructed by 1979. A recent project in the Southwest U.S. has been approved for experiment by the Energy Research and Development Administration. Interest in this energy source in the South Atlantic region has intensified in the past couple of years with the increase in conventional space heating fuel costs, however, only a few individual efforts have been developed to-date.

B. IMPACTS

Although fuel costs for backup systems and maintenance costs for solar units are small when compared with operating costs of conventional heating and cooling systems, the high initial or "fixed" costs of solar units make them unattractive to many homeowners and builders. The typical solar heating system for a home costs $5,000-$6,000 (including costs of a standby conventional furnace) compared to $1,000-$2,000 for a conventional fossil-fuel home heating unit. However, the rising cost of the gas and oil needed by the conventional heaters means that, over time, the greater fixed costs of solar systems will be balanced by their lack of fuel costs.

Larger-scale generation of electricity using solar energy is another promising application which is receiving funding. Authorization for $33 million for solar electric program was requested during fiscal 1975-almost $26 million more than the fiscal 1974 appropriation. A number of technical and engineering problems now prevent commercialization of solar steam-electric plants, though pilot projects are well underway. It is estimated that solar electricity will be available on a significant scale in 10 to 15 years or more.

Among the disadvantages of solar-electric-energy are high capital costs, expensive maintenance of solar collectors, thermal waste disposal, and distortion of local thermal balances.

ENVIRONMENTAL IMPACT

The impacts so far identified with solar energy are relatively minimal. The primary effects of the use of this energy sources on a wide scale will be land use. Due to the low density of the energy, large areas will be necessary for the collectors. However, the land use compares favorably with other forms of energy use such as coal extraction.

The only other area for concern known so far is thermal pollution. Direct use in space heating has no thermal effects. However, for solar electric power generation, heat will have to be collected and transferred to the generator. Some localized thermal pollution may occur as a result, but the problem is not expected to be significant. Finally, solar plants can only operate intermittently. Thus, the energy will have to be either stored, or backup fossil plants will have to be built. These will have their own sets of environmental constraints.

Additional details on this resource alternative is found in Chapter 11 of *Energy Alternatives: A Comparative Analysis*.

8. Oil Imports

A. DESCRIPTION

U.S. reliance on imported oil has increased steadily in the last decade. Competition on the world market and recent cutbacks in Middle Eastern oil exports (oil embargo of 1973) have raised concerns about availability and increasing domestic demand restrict potential imports from the Western Hemisphere nations, particularly Venezuela and Canada. Increasing imports from the Middle East brings problems of stability of supply, balance of payments, and U.S. off-loading capacity.

The average cost to refiners of imported crude petroleum in April 1977, was $14.35/bbl compared to an average cost of $9.34/bbl for domestic crude petroleum. Domestic wellhead crude petroleum prices range from $5.16 (lower tier), $1097 (upper tier), to $13.28 (stripper), yielding a domestic average wellhead price of $8.41 (actual).

During the first 5 months of 1977, an average of 8.9 millions of barrels of crude oil and refined products were imported into the U.S. each day. During the same time period, average domestic production of crude oil amounted to 7.9 million barrels per day, and crude oil imports amounted to 6.5 million barrels per day.

During calendar year 1976, the U.S. imported an average of 5,287,000 barrels of crude oil and 1,909,000 barrels of refined oil each day. The peak production of 170,000 barrels per day from this proposed sale thus represents 3% of daily U.S. crude imports. On a regional basis, the Atlantic region (P.A.D.I.) imported an average of 1,415,000 barrels of crude oil and 1,680,000 barrels of refined oil each day in 1976. The peak daily production from this sale would thus represent 11% of the daily crude imports to the Atlantic region.

B. ENVIRONMENTAL IMPACT

The primary hazard to the natural environment of increased oil imports is the possibility of oil spills, which can result from accidental discharge, intentional discharge, and tanker casualties. Intentional discharges would result largely from tank cleaning operations. The effects of chronic low-level pollution are largely unknown. The worldwide tanker casualty analysis indicates that, overall, an insignificant amount of the total volume of transported oil is spilled due to tanker accidents. However, a single incident such as the breakup of the Torrey Canyon can have disastrous results. However, it is probable that crude oil produced as a result of the proposed sale will be transported by U.S. flag ships or their equivalent, while imported oil may be transported via foreign tankers. Because U.S. flag ships have a better oil spill incident record than the worldwide tanker fleet average, tankering of OCS produced oil may result in less oil spillage due to accident and routine operations, than would imports of a similar volume of crude oil.

Of more concern though is the impact to the social and economic environment. The potential for a future embargo under this option is such that American productivity and policy could become subservient to foreign influence. Particularly sensitive would be the South Atlantic States oil and gas supply which already is somewhat dependent on foreign energy sources at the present time. Prices, products, and employment in the region may fluctuate, and fluctuate severely, because of international decisions beyond the control of South Atlantic States. On a more subtle level, political alignments and policies of the U.S. could become tied to those of foreign oil powers. This option is the least acceptable for continued American energy independence.

9. Natural Gas Imports

A. DESCRIPTION

Imports of natural gas via pipeline have come largely from Canada, with small amounts from Mexico. In 1973, net pipeline imports from Canada were 1,028 bcf, about 4.6% of total natural gas used in the U.S. These imports were about 33% of Canada's natural gas production. Natural gas pipeline imports from Mexico have not been a significant part of U.S. supply. In 1973, imports from Mexico were 1.6 bcf.

Mexico may become a significant source of future imports because of its natural gas resources. Imports from Mexico were of a local nature until 1957 and have declined since 1969. Canadian intentions to gradually phase out oil exports to the U.S. also puts into question increased natural gas pipeline exports. Imports of liquefied natural gas into the Savannah area are already an alternative source in this area.

Natural gas imports would have to be about 0.4 to 1.4 billion cubic feet per day to replace the gas production estimated to be available from this proposed South Atlantic sale.

B. ENVIRONMENTAL IMPACT

The environmental impacts of increasing gas imports derive mainly from the possible increased use of land for pipeline construction. A further impact is the risk of explosions and fires. As with imports of oil, the South Atlantic States could become dependent on foreign control of supply. Fluctuations of that supply could influence quality of life, productivity, and employment. American policies could also become influenced by decisions of foreign oil power, much as they could under the option of increasing oil imports.

10. Liquefied Natural Gas Imports

A. DESCRIPTION

The growing shortage of domestic natural gas has encouraged projects to import liquefied natural gas (LNG) under long-term contract. Large scale shipping of LNG is a relatively new industry. Several LNG projects are now under consideration on the Pacific, Atlantic, and Gulf coasts. Security of foreign LNG is questionable. The complexity of and length of time involved in implementing these proposals has been increased by the need for negotiating preliminary contracts, securing the approval of the Federal Power Commission and the exporting country, and making

adequate provision for environmental and safety concerns in the proposed U.S. facilities.

B. ENVIRONMENTAL IMPACT

The environmental impacts of LNG imports arise from tankers; terminal, transfer, and regasification facilities; and transportation of gas. The primary hazard of handling LNG is the possibility of a fire or explosion during transportation, transfer, or storage.

Receiving and regasification facilities will require prime shoreline locations and dredging of channels. Regasification of LNG will release few pollutants to the air or water.

LNG imports will influence the U.S. balance of payments. This impact will depend on the origin and purchase price of the LNG, the source of the capital, and the country (U.S. or foreign) in which equipment is purchased and LNG tankers are built.

11. Geothermal Energy

A. DESCRIPTION

Geothermal energy is primarily heat energy from the interior of the earth. It may be generated by radioactive decay of elements such as uranium or thorium, and friction due to tidal or crustal place motions.

There are four major types of geothermal systems: hot water, vapor dominated, geopressured reservoirs, and hot dry rock systems.

In addition to electricity, geothermal energy can offer a potential for space heating, industrial processing, and other nonelectric uses in many areas which presently are highly dependent upon oil and gas for energy needs. However, geothermal electric generating plants are smaller than conventional plants and require a greater amount of steam to generate the same amount of energy. This is due to the fact that temperatures and pressures associated with geothermal areas are lower than those created at conventional power plants. In some areas, geothermal resources may have potential for space heating, industrial processing, and other non-electric uses.

The greatest potential for geothermal energy in the U.S. is found in the Rocky Mountain and Pacific regions; some potential exists in the Gulf Coastal Plain of Texas and Louisiana. The Geysers field in California is the most extensively developed source of geothermal energy in the U.S. It has been producing power since 1969. Exploration efforts are also underway in the Imperial Valley, Salton Sea, Mono Lake, and Modoc County, California.

Within 20 years, geothermal energy may account for about 1 to 2% of total U.S. energy and about 5% of California's energy consumption.

However, this energy source is not thought to be beneficial to the enegy need of the South Atlantic area. Large resources of this type are not known to be located in sites in close proximity to the Southeast States that would benefit from oil and gas resources that are anticipated from this proposed sale.

B. ENVIRONMENTAL IMPACT

A number of gases are associated with geothermal systems and may pose health and pollution prolems. These gases include ammonia, boric acid, carbon dioxide, carbon monoxide, hydrogen sulfide, and others. However, adverse air quality impacts are generally less than those associated with fossil-fuel plants. Also associated with geothermal energy systems are saline waters which must be disposed of and isolated from contact with ground water regimes.

Land quality problems stem from disturbance due to construction of related facilities, and possible ground subsidence which, in turn, can cause structural failures and loss of ground water storage capacity.

12. Other Energy Sources

The high cost and rapidly shrinking reserves of the traditional energy fuels have encouraged research into new and different sources for potential energy. Some of these alternate sources have been known for decades but high costs and technical problems have prevented their widespread use. They include tidal power, wind power, organic fuels and ocean thermal-gradients among others.

Environmental impacts of these alternatives are difficult to assess, especially as a great amount of research and development remains to be completed before operational scale systems can be developed, tested, and evaluated for production and application.

The date of commercial availability of such alternatives will depend on the cost of the traditional enegy fuels, the level of Federally subsidized research through ERDA assistance, and the solution of engineering and technical problems.

13. Combination of Alternatives

Within the South Atlantic region a combination of some of the most viable energy sources available to this area, discussed above, could be utilized to attain an energy equavalent comparable to that estimated to be produced within the 20-year field life anticipated by this proposed action. However, this combination of alternatives, in order to attain the needed energy mix peculiar to the infrastructure of this area, would have to consist of energy sources attainable now or within the 20-year timeframe that are transferable to the technology presently used, i.e., viable substitutes would have to be available for the petroleum and natural gas required by the petrochemical industrial complex, the petroleum used for the transportation section, and the electricity and fuels used in the South Atlantic residential and commerical sectors.

Part II of the *Energy Alternatives: A Comparative Analysis*, particularly Chapter 16 "Comparing the Economic Costs of Energy Alternatives," discusses the factors that must be involved in developing technically and economically appropriate energy alternatives.

The most viable domestically available energy alternatives for the South Atlantic region, technologies and economies allowing, probably would consist of the use of coal (for use in coal-fired power plants) coal gasification plants (to provide synthetic natural gas), nuclear power and solar energy (to provide energy for space heating), and oil shale processing (to provide petroleum), in addition to conventional oi and gas resources. The environmental impacts of each of these alternatives has been discussed briefly in the previous sections.

Based upon the range of undiscovered recoverable resources estimated by the USGS for this proposed South Atlantic sale area, Table C-1 presents the energy equivalents which would be required of other energy sources to substitute for this proposed action.

The future U.S. energy source mix will depend on a multiplicity of factors, among them the identification of resources, research and development efforts, development of technology, rate of economic growth, the economic climate, changes in life-style and priorities, capital investment decisions, energy prices, world oil prices, environmental quality priorities, government policies, and availability of imports.

The Project Independence Report (FEA, 1974), estimated U.S. energy demand and domestic supply for four cases. These data are shown on Table C-2.

Table C-3 shows the breakdown of total domestic fuel supplies for the base case and the accelerated supply case.

The increases in domestic supply under the accelerated supply case are due largely to the following:

- Standardization and expedited licensing to increase nuclear capacity 15% by 1985.
- Significant new leasing, exploration and development of the Pacific, Gulf of Alaska, and Atlantic OCS.
- Additional oil and gas pipelines from Alaska to the lower 48 states.
- Increased Federal leasing and actions to allow additional oil shale production.
- Opening Naval Petroleum Reserves #1 and #4 to full scale commercial development.
- Possible mandatory allocation or other actions to assure critical materials and equipment to meet expected production levels.

For the base case, the Project Independence Report envisions the role of alternative energy sources as the following:

- Petroleum production is severely constrained in the short run and greatly affected by world oil prices in the long run. Before 1977 there is little that can prevent domestic production from declining or at best remaining constant.
- Coal production will increase significantly, but is limited by lack of markets. Increases are limited by rate of electric growth, increasing nuclear capacity, and environmental restrictions.
- Potential increases in natural gas production are limited.
- Nuclear power is expected to grown from 4.5% to 30% of total electric power generation.
- Synthetic fuels will not play a major role between now and 1985.
- Shale oil could reach 250,000 B/D by 1985 at $11 world oil prices, but would be lower if $7 prices prevail.
- Geothermal, solar, and other advanced technologies are large potential sources, but will not contribute to our energy supplies until after 1985.

In the interest of clarity of presentation, the early parts of this section have discussed separately each potential alternative form of energy as a possible substitute to the proposed sale. However, it is unlikely that there will ever be a single definitive choice between energy sources, or that development of one source will preclude development of others. Different energy sources will differ in their rate of development and the extent of their contribution to total U.S. energy supplies. Understanding of the extent to which they may replace or complement offshore oil and gas requires reference to the total national energy picture. Relevant factors are:

- Historical relationships indicate that energy requirements will grow at approximately the same rate as gross national product.

Table C-1. Energy Needed from Other Sources to Replace Anticipated Oil and Gas Production from Proposed South Atlantic Sale No. 43

	Range	
	Low	High
Total Crude Oil Production (barrels) Annual Average (25 year life)	0.3×10^9	1.0×10^9
Total Natural Gas Production (cubic ft.) Annual Average (25 year life)	1.9×10^{12}	6.8×10^{12}
Btu Equivalent		
Crude Oil Btu Equivalent	1.68×10^{15}	5.65×10^{15}
Natural Gas Btu Equivalent	1.94×10^{15}	6.95×10^{15}
Total Oil and Gas Equivalent	3.62×10^{15}	12.60×10^{15}
Daily Average Btu	396.7×10^9	1380.8×10^9
Primary Energy Source Equivalents		
Oil Equivalent (barrels		
Total	0.6×10^9	2.3×10^9
Annual Average	25.9×10^6	90.9×10^6
Daily Average	70,800	246,600
Gas Equivalent (cubic feet)		
Total	3.5×10^{12}	12.3×10^{12}
Annual Average	141.6×10^9	493.6×10^9
Daily Average	0.4×10^9	1.4×10^9
Coal Equivalent (tons)		
Total	151×10^6	525×10^6
Annual Average	6×10^6	21×10^6
Daily Average	16,500	57,500
Secondary Energy Sources		
Gas from Coal (High Btu gas')		
Number of plants (250×10^9 Btu/day/plant)	2	6
Coal Requirement: Total (tons)	430.7×10^6	$1{,}292.1 \times 10^6$
Annual (tons)	17.2×10^6	51.7×10^6
Daily (tons)	47,200	141,600
Oil from Oil Shale[2]		
Oil Shale Requirement: Total (tons)	857×10^6	$3{,}286 \times 10^6$
Annual (tons)	34×10^6	131×10^6
Daily (tons)	93,900	360,100

Table C-1 (continued)

	Range	
	Low	High
Electricity from Nuclear Energy		
Number of light water reactors (1000 MW(e) capacity)	2	5
First core fuel U_3O_8[4]	60 tons	150 tons
Annual Reload	20 tons	50 tons

Conversion Factors:

1 barrel of oil = 5.6×10^6 Btu
1 cubic foot of natural gas = 1,021 Btu
1 ton of coal = 24×10^6 Btu

Table C-2 U.S. Energy Demand and Domestic Supply, 1985

World Oil Price	$11 per barrel	
	Demand (quads)	Domestic Supply (quads)*
Base case w/ and w/o emergency programs	102.9	96.3
Accelerated supply	104.2	104.2
Conservation	94.2	91.8
Accelerated supply plus conservation	96.3	96.3

*Quad - a quadrillion Btu's.

The data cited in this section are taken from: Federal Energy Administration, Project Independence Report, November 1974. A more recent report, The National Energy Outlook, by FEA updates this material.

Table C-3 Domestic Fuel Consumption by Source, 1985 (in quads)

	1972 Actual	$11 world oil	
		Base Case	Acc Supplu
Coal	12.5	22.9	20.7
Oil	22.4	31.3	38.0
Gas	22.1	24.8	25.5
Hydro and Geo-thermal	2.9	4.8	4.8
Nuclear	0.6	12.5	14.7
Synthetics			0.4
Imports	11.7	6.5	0
Total	72.1	102.9	104.2

Energy requirements can be constrained to some degree through the price mechanisms in a free market or by more direct constraints. One important type of direct constraint operating to reduce energy requirements is through the substitution of capital investment in lieu of energy; e.g., insulation to save fuel. Other potentials for lower energy use have more far-reaching impacts and may be long range in their implementation—they include rationing, altered transportation modes, and major changes in living conditions and life styles. Even severe constraints on energy use can be expected to only slow, not halt, the growth in energy requirements within the timeframe of this statement.

Energy sources are not completely interchangeable. Solid fuels cannot be used directly in internal combustion engines for example. Fuel conversion potentials are severely limited in the short term although somewhat greater flexibility exists in the longer run and generally involved choices in energy-consuming capital goods.

The principal competitive interface between fuels is in electric powerplants. Moreover, the full range of flexibility in energy use is limited by environmental considerations.

A broad spectrum of research and development is being directed to energy conversion—more efficient nuclear reactors, coal gasification and liquefaction, liquified natural gas (LNG), and shale retorting, among others. Several of these should assume important roles in supplying future energy requirements, though their future competitive relationship is not yet predictable.

Major potential for filling the supply/demand imbalance for domestic resources are: More efficient use of energy, environmentally acceptable systems which will permit production and use of larger volumes of domestic coals, accelerated exploration and development of all domestic oil and gas resources, and development of the Nation's oil shale resources.

Of the foregoing, increased domestic oil and gas production offers considerable possibilities, although adequate incentives must exist for indicated and undiscovered domestic resources to be discovered and extracted.

The acceptability of oil and gas imports as an alternative is diminished by:

The security risks inherent in placing reliance for essential energy supplies on sources which have demonstrated themselves to be politically unstable and prone to use interruption of petroleum supplies to exert economic and political pressure on their customers.

The aggravation of unfavorable international trade and payments balances which would accompany substantial increases in oil and gas imports.

Apparent high costs of liquefying and transporting natural gas other than overland by pipeline.

D. Other Alternatives Within the Proposed Action

1. Notification of Onshore Facilities Required for Exploration Activity

The Coastal Zone Act Amendments of 1976 require that exploration and development plans receive a certificate of concurrence with state CZM plans, once states have approved programs under Section 306 of the CZM Act. A six month period is granted in order for the states to review these plans prior to a decision as to concurrence. Delay of the sale until CZM plans are implemented would assure that no exploration or development plans resulting from the proposed sale are approved without this certificate.

On the other hand, proposed Stipulation 3 (Section VIII. D.6.) would require that information regarding support facilities be provided to the governors of affected states prior to approval of exploration plans. OCS Order No. 15 (Appendix G) contains a similar provision for development plans. While these requirements would not require state approval of proposer's plans, they would provide information essential to planning and thus aid in mitigating any adverse affects of onshore facility siting.

IMPACTS OF THIS ALTERNATIVE

This proposal would permit early identification of the possible locations of support facilities, employment, and boat and helicopter traffic which would originate at the facility. This knowledge would permit consideration to be given to the provision of additional facilities required for the conduct of exploration work. Specific requirements for housing, air traffic and boat traffic requirements, and such public needs as schools, hospitals and :olid waste disposal would be known on a site specific basis as soon as possible.

CUMULATIVE IMPACTS

The cumulative impact of this alternative would be to continue the earliest possible planning to deal with anticipated impacts.

Since the proposal would provide public information, authorities in one state or reqion would have more expeditious access to the types of facilities required in other areas, and could adjust their plans or actions accordingly.

2. Government Exploratory Drilling Prior to Leasing

Exploratory drilling conducted or sponsored by the Federal Government prior to holding a lease sale would be an alternative within the proposed action. This would involve an alternative approach to one aspect of the present Federal leasing program. For such drilling to be done by the Federal government under existing law, it would have to be justified or accomplished within the confines of the OCS Lands Act (43 U.S.C. 1340). At the present time there is little exploratory drilling on the OCS prior to leasing, however, exploratory drilling for the purpose of obtaining geological data has been permitted. It is not the purpose of these exploratory tests to discover oil or gas, but to obtain information concerning the physical characteristics of the rock that may be present in the area.

Although this information is made available to the U.S. Geological Survey for use by the Federal government in determining the value of tracts proposed for leasing, it is not generally available public information.

Under present regulations, the data collected from a test well must be available for release to the public five years after completion of the tests, or 60 calendar days after the first Federal lease is issued within 50 miles of the site.

Proposed amendments to the Outer Continental Shelf Lands Act of 1953 now pending in Congress (HR 1614 and S.9) and responses by the Secretary of the Interior to requests for the views of the Department by the respective committees, consider, among other modifications, measures to facilitate the exploration and development of the OCS.

The Department of the Interior supports the provisions granting the Department authority to contract for exploratory drilling and the concept that such authority should be exercised when the national interest requires such action.

If exploratory drilling on structures were conducted prior to determining potential areas for leasing, and the results of this exploratory drilling were made public immediately, those Federal, state, local and private organizations developing plans, or considering the advisibility of incremental investments would have access to information that might influence these plans.

Public availability of data concerning the geological section present beneath the OCS in the

Southeast Georgia Embayment could have two opposite effects. In the event that the results were encouraging, additional interest on the part of prospective bidders would result, and if the results were discouraging, a decline in the existing interest on the parts of prospective bidders would result. Positive indications of the presence of oil and gas would permit some prelininary designations of probable shore points where facilities might be installed, and the absence of oil and gas would increase the probabilities that certain areas would not be impacted by OCS activities. These considerations would tend to focus available resources on the most likely areas, and permit more definitive analysis of the possible environmental impacts of OCS operations.

IMPACTS OF THIS ALTERNATIVE

The adoption of this alternative would have little effect on the onshore areas adjacent to proposed Sale No. 43, with the exception that a government sponsored exploration program might provide public information that would provide additional data for estimating probable points that might be affected by OCS related activity.

CUMULATIVE IMPACTS OF THIS ALTERNATIVE

The principal impact that might result from this alternative would be the public availability of pertinent information that would affect public and private planning for future needs. In the event that exploratory drilling results were not encouraging in one region, interest would probably be directed to other areas. Public availability of these data would permit evaluation by the agencies concerned as to the likelihood of planning or action on their part.

A. ALLOW EXPLORATION BY INDUSTRY UNDER PROSPECTING PERMIT WITH A PREFERENCE RIGHT TO DEVELOP FOR OIL

The U.S. Senate and House of Representatives is currently considering amendments to the Outer Continental Shelf Lands Act of 1953. Among other modifications under consideration are measures to provide for the enhancement of competition for leases to assure a fair return to the public for its resources. Among the proposed changes would be authorization of a number of specific bidding systems and require at least one-half of all acreage leased in each frontier area under the new program be leased under the specified systems, other than cash bonus bidding. The Department of the Interior concurs in the bill's explicit authorization of new bidding systems but is concerned that the legislation provide for experimentation with new systems not specified by the bill or with variations of systems which are specified.

The cash bonus system, which has been the basic system employed for the awarding of minerals leases on the OCS since 1953, has yielded approximately $20 billion dollars to the Federal government in the form of bonuses, rentals, royalties, and shut-in gas payments through the year 1975. The total production value of the minerals produced during this time has amounted to approximately $23 billion dollars, and therefore the cumulated revenue accruing to the government represented 86% of the total value of mineral production.

Issuing prospecting permits providing for preference rights to leases is a form of separation of exploration and development. It would require the consideration of many factors such as the precise nature of the preferential right, the time required for negotiation between exploration and production activities, and the terms under which development activity would be undertaken.

IMPACTS OF THIS ALTERNATIVE

For the area included within proposed OCS Sale No. 43, the adoption of this alternative would probably result in a delay in the exploratory drilling, as a result of the necessity to develop firm concepts as to which rights would be conveyed to prospective bidders. The length of this possible delay time cannot be estimated at the present time. On the other hand, the identification of oil or gas prone areas would permit more precise identification of potential environmental conflicts prior to development.

CUMULATIVE IMPACTS OF THIS ALTERNATIVE

The impacts that might result from the adoption of alternate bidding systems on the OCS program cannot be estimated at this time. The Department of the Interior has recommended the authorization of new bidding systems and believes that substantial leasing should be undertaken to test and develop systems other than the cash bonus bid system currently in use.

3. State Participation in Development Decisions

On November 4, 1975, the Department of the Interior published an amendment to the drilling

and development plan regulation (30 C.F.R. 250.34), providing *inter alia*, for State participation in decisions concerning the develoomment of OCS leases (see Appendix H). Prior to being revised, 30 C.F.R. 250.34 required that a lessee submit a development plan to the Supervisor for approval before the commencement of a development program on a lease. That regulation now requires, *inter alia*, that the Supervisor shall provide the Governors of directly affected States with a copy of the plan for their review and comment at least 60 days before the Supervisor approves the plan.

30 C.F.R. 250.34, as revised, also provides for the State to receive information to better assess and plan for the onshore-offshore impacts of OCS development. At least 30 days before a lessee submits a development plan to the Supervisor for approval, he must deliver to the Governor of each directly affected State information about the development to be proposed. The information to be provided, which is not a part of the development plan itself shall include a description of all onshore and offshore facilities and operations related to the proposed development, including location, size, requirements for land, labor, materials and energy, and timing of development and operations, and any other related information as may be required by the Supervisor. A Governor has 30 days after the final delivery of this supplementary information within which to notify the Supervisor whether the information meets the requirements of the regulation. If the Governor notifies the Supervisor that it does not, the Director of the Geological Survey shall review the information and either order the lessee to submit additional information or determine that the information meets the requirements of the regulation. If the Director determines the latter, the 60-day period within which the Governor has to review the development plan shall begin from the date of the Director's decision.

A Governor of a directly affected State will therefore have a minimum of 60 days within which to review and comment on a development plan. This period does not include the period of at least 30 days he has to acquaint himself with the supplementary onshore-offshore impact information, and any additional time he may have because of delays before the 60-day period begins.

In drafting these new regulations, the Department considered both shorter and longer periods of time for State review of development plans and the effect of delays in potential lease development that might result from longer review periods. The Department always has the option to amend the regulations if the procedures for State participation in reviewing development plans are found to be inadequate.

A possible time frame alternative to the new 30 C.F.R. 250.34 available for the Secretary when considering a period of State review of development plans is to suspend leases for a greater period of time between the exploration and development plans that is provided for under the new regulation. This potentially prolonged period of review might be beneficial where the plans involve onshore facilities, such as pipeline landing sites and onshore support facilities, the ultimate approval of which would be within the jurisdiction of the State. State and local officials have expressed the view that they would be forced to make hasty and ill-informed decisions regarding potential onshore facilities without such a review period. Customary suspension between exploratory and development phases could provide a more orderly and efficient procedure for Federal and State decisions concerning those potential offshore and onshore aspects of OCS lease development within exclusive or concurrent jurisdiction of the respective governments.

On the other hand, the adoption of a period of suspension between the exploration and development stages would result in a longer period of delay in initiating potential development operations. Delays increase costs to the operator which might be passed on to the consumer; it is possible that in marginal fields, lengthy delays might preclude production of the oil and gas, depending on the price of oil at the time.

However, before ordering a suspension of operations as described above, the Secretary would have to show that the suspension is in the interest of conservation of natural resources, as contemplated by Section 5(a) of the OCS Lands Act (43 U.S.C. 1334(a)). Also, for the suspension to be legally supportable, it must hold promise of the right of development at some future time. If the Secretary, in certain circumstances, should decide that public interest requires termination of an OCS lease at the end of the exploratory phase, he would be unable to cancel the lease without enactment of special legislation by Congress. This legislation might take the form of either separate

leases for exploration and then development, or exploration with the possibility of lease termination at the discretion of the Secretary before development can occur. Since the results from these legislative alternatives are not known, we cannot say more than, without incentives to take risk, petroleum companies may reduce the amount and number of bids for leases or they may not bid at all.

In a different context, a period of six months has been provided under the Coastal Zone Management Act of 1972 (16 U.S.C. 1451-1464), to a State with a Federally-approved coastal zone management program to indicate whether or not it concurs with a certification by an applicant for a Federal permit subject to the Act, that a proposed activity is consistent with said program.

Another potential alternative available to the Secretary is to require a plan of development to include more comprehensive information than required in the new regulation. The plan could be required to include such additional information as the following:

(1) the number and bottom hole locations of wells to be drilled from each platform;
(2) all abnormal pressure maps;
(3) all information on shallow hazards;
(4) anticipated disposition of all produced hydrocarbons; and
(5) an environmental assessment of all potential offshore and onshore impacts of the operations described in the specific plan of development.

This information would give States a more specific indication of the magnitude of anticipated production and resulting impacts. The problem is that it would require lessees to divulge privileged information and might ultimately discourage the exploratory development and production of oil and gas resources on the OCS.

If it is determined that approval of a plan of development involves a major Federal action significantly affecting the quality of the human environment, and if the action has not been covered previously in an environmental impact statement, an EIS would be prepared in accordance with Section 102(c) of the National Environmental Policy Act of 1969 before taking action on a request for approval of the development plan.

In summary, the impact of the adoption of one of these alternatives to the new 30 C.F.R. 250.34 regulation could allow for an even more orderly and comprehensive review of plans of development than that established under the new regulation itself. Additional time would be allowed for more cooperation and coordination between Federal and State Governments in making decisions which bear upon those aspects of potential OCS operations and siting of facilities within the exclusive or concurrent jurisdication of said governments.

A greater period of delay in securing potential development of OCS oil and gas resources and consequent delay in channeling such production into the domestic supply of energy could occur depending upon the duration of the suspension period. While a period of three, four, or more months for State review and comment might be provided, it is not possible to predict the additional period of time that might be involved in the evaluation of in depth State comments and potential efforts of the parties to resolve any differences that might arise.

4. Implementation of Energy Facility Siting Legislation at the State Level

At present, none of the U.S. South Atlantic states has enacted legislation to affirmatively identify and study specific sites that could appropriately accommodate key energy-related facilities. Existing state actions focus on regulating the placement of such facilities after a specific site has been identified by the proposer. In essence, the states' regulatory functions are reactionary in that they are not activated until a specific proposal has been made.

The proposed Sale No. 43 could be delayed until such time as the adjacent coastal states have developed and implemented legislation which would guide and/or control energy related facility siting. This might take the form of identification of specific sites for such facilities and/or acquisition of such sites by states. Such a positive approach to facility siting could minimize adverse impacts of energy-related facilities by providing a mechanism to assure that facilities are compatible with their environment. Positive impacts would also result through providing direction to desired economic growth.

Section 305(b)(8) of the Coastal Zone Act, as amended, provides stimulus for this approach. That section states that "the management program for each coastal state shall include . . . a planning process for energy facilities likely to be located in, or which may significantly affect, the coast zone, including, but not limited to, a

process for anticipating and managing the impacts from such facilities''. Energy facilities, in the context of the amendment, includes OCS related facilities such as crew and supply bases, platform fabrication yards, gas processing plants, and pipelines and associated terminals.

The Coastal Zone Management Act Amendments provide that the states have until October 1978 to implement this section, even when state programs have already received approval under Section 306.

The impacts associated with this alternative would be the provision of detailed site requirements to states adjacent to the sale area, and an opportunity for more environmentally sensitive siting of facilities. It is not possible to determine the time when such state planning mechanisms will be established. Consequently, it is not possible to estimate the length of delay in deciding whether or not to hold the proposed lease sale.

Planning for anticipated impacts, covering a broad range, could be carried forward, but the level of mitigation of these impacts is not yet quantifiable.

5. Requirement of Bird Repelling Techniques during Appropriate Oil Spill Situations

Through a Notice to Lessees, amendment to Operating Order No. 7 (both of which would have to be implemented by the U.S. Geological Survey) or a lease stipulation (which would be implemented by BLM), the storage and use of bird scare techniques could be required of those operating under leases issued as a result of proposed Sale 43. Birds sensitive to impact due to oil spills in the South Atlantic would be mostly wintering or migrating waterfowl and other coastal birds, rather than birds rafting offshore. Therefore, such a regulation could mandate storage of such devices at onshore areas where oil spill containment and cleanup equipment is kept. Such a regulation could also mandate deployment of these devices to susceptible shoreline areas in the event of an oil spill. Propane guns or best available technology could be required.

The coastal area of the South Atlantic supports large and varied populations of birds. It is also a part of the Atlantic flyway utilized for migration between southern wintering areas and northern nesting areas. National Wildlife Refuges such as Cape Romain and Merritt, as well as state wildlife management areas are located along the South Atlantic coast.

The Department of the Interior's Oil Spill Risk Analysis (Appendix M) indicates a fairly low risk to coastal birds as a result of oil spills. Probabilities of at least one major spill occurring and impacting refuges, brown pelicans and coastal or pelagic rookeries range from 2% to 9% (Table 4, Appendix M). Probabilities for impact to marshes and wetland areas in general, both important avian habitat areas, are 14% to 17%.

However, the risk of impact to birds may be further reduced by implementation of this alternative. The use of scare devices to repel marine birds for sustained period of time from the area of an oil spill has proven practical and effective for several species of water-oriented birds. The devices are presently available in the South Atlantic for use in the case of spill, but no requirements for their use or deployment are presently in effect. It should be pointed out, however, that the devices are not effective for all species and more research may be required.

6. Alternative Administrative Procedures (Stipulations) Pertaining to: Biological and Cultural Resources, Information Provided to States, and Transport of Oil and Gas.

During the course of developing potential lease stipulations to mitigate certain identified adverse impacts of the proposed lease sale, there was extensive Departmental coordination with and participation by the southeastern coastal States. The lease stipulations recommended by the responsible Departmental officials are described in Section IV. The southeastern coastal States have suggested additional provisions for inclusion in any lease stipulations to be required if the proposed lease sale is held. These alternative provisions are described hereunder.

Stipulation No. 1—Biological Resources

Prior to any drilling activity or placement of any fixed structures or pipeline or any other exploration or production activity, the lessee will submit to the Supervisor as part of his exploration and/or development plan a bathymetry map, prepared utilizing remote sensing and/or other survey techniques. This map will include interpretations for the presence of live bottom areas within a minimum one-mile radius of the proposed exploration or production activity site.

For the purpose of this stipulation, live bottom areas are defined as those areas which contain biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography; or whose lithotope favors the accumulation of turtles and fishes.

If it is determined that the remote sensing data indicate the presence of hard or live bottom areas, the lessee will also

submit to the Supervisor photo-documentation of the sea bottom near proposed exploratory drilling sites or proposed platform locations.

If it is determined that live bottom areas might be adversely impacted by the proposed activities, then the Supervisor, following consultation with the Manager, New Orleans OCS Office, BLM; Regional Director, Fish & Wildlife Service; and Governors of affected States, will require the lessee to undertake any measures deemed economically, environmentally, and technically feasible to protect live bottom areas. These measures may include, but are not limited to, the following:

a. The relocation of operations to avoid live bottom areas.
b. The shunting of all drilling fluids and cuttings in such a manner as to avoid live bottom areas.
c. The transportation of drilling fluids and cuttings to approved disposal sites.
d. The monitoring of live bottom areas to assess the adequacy of any mitigation measures taken and the impact of lessee initiated activities.

In the fulfillment of this provision of the lease the Supervisor accepts the responsibility of providing the Manager, New Orleans OCS Office, BLM; Regional Director, Fish & Wildlife Service; and the Governors of affected States, upon the request of such agencies or Governors, with such maps of the leased areas and other information regarding the areas as are produced pursuant to this stipulation.

Evaluation

Consultation with the affected coastal States and Interior agencies such as those referred to in this alternative stipulation would be useful in that additional viewpoints of concerned officials would be obtained relative to the nature of actions which could be taken to protect live bottom areas.

A lease stipulation is not, however, an appropriate vehicle for specifying the procedures to be followed in the consultative process. Lease stipulations are terms of a contract entered into by the Department and the lessee. This alternative stipulation would not and could not bind the lessee to do anything. It would also involve internal procedures of the Department which are or can be appropriately provided for outside the lease contract.

Placement in a lease stipulation of procedures dealing with this consultative process would not in itself serve to lessen any potential environmental effect of the proposal.

Stipulation No. 2—Cultural Resources

If the Supervisor, following consultation with the Manager, New Orleans OCS Office, BLM; Regional Director, Fish & Wildlife Service; and the Governor of any affected State, or otherwise having reason to believe that a site, structure or object of historical or archaeological significance, hereinafter referred to as "cultural resource", may exist in the lease area, gives the lessee written notice that the lessor is invoking the provisions of this stipulation, the lessee shall upon receipt of such notice comply with the following requirements:

Prior to any drilling activity or the construction or placement of any structure for exploration or development on the lease, including but not limited to, well drilling and pipeline platform placement, hereinafter in this stipulation referred to as "operation", the lessee shall conduct remote sensing surveys to determine the potential existence of any cultural resource that may be affected by such operations. All data produced by such remote sensing surveys as well as other pertinent natural and cultural environmental data shall be examined by a qualified marine survey archaeologist to determine if indications are present suggesting the existence of a cultural resource that may be adversely affected by any lease operation. A report of this survey and assessment prepared by the marine survey archaeologist shall be submitted by the lessee to the Supervisor and to the Manager, Bureau of Land Management (BLM) Outer Continental Shelf (OCS) Office for review.

If such cultural resource indicators are present the lessee shall: (1) locate the site of such operation so as not to adversely affect the identified location; or 2) establish, to the satisfaction of the Supervisor, on the basis of further archaeological investigation conducted by a qualified marine survey archaeologist or underwater archaeologist using such survey equipment and techniques as deemed necessary by the Supervisor, either that such operation shall not adversely affect the location identified or that the potential cultural resource suggested by the occurrence of the indicators does not exist.

A report of this investigation prepared by the marine survey archaeologist or underwater archaeologist shall be submitted to the Supervisor who will then distribute it to the Governors of the affected States, the National Park Service through the Regional Director, Fish and Wildlife Service, and the Manager, BLM OCS Office for their review. Should the Supervisor, upon consultation with the above agencies, determine that the existence of a cultural resource which may be adversely affected by such operation is sufficiently established to warrant protection, the Supervisor shall notify the lessee who shall take no action that may result in an adverse effect on such cultural resource until the Supervisor has given directions as to its disposition.

The lessee agrees that if any site, structure, or object of historical or archaeological significance should be discovered during the conduct of any operations on the leased area, he shall report immediately such findings to the Supervisor and make every reasonable effort to preserve and protect the cultural resource from damage until the Supervisor has given directions as to its disposition.

Evaluation

The comments under Alternative Stipulation No. 1 also apply to this alternative. The report of the marine survey archaeologist referred to would provide a basis for informed comment by the affected coastal State. But, again, the distributive and consultative procedures referred to can be appropriately provided for outside the lease contract. The participation of the Interior agencies referred to is provided for already under Secretarial Order 2974.

Stipulation No. 4—Information Provided to States

To provide information to coastal states and thus assist them in planning for the impact of activities during exploration under this lease, the lessee shall submit, for review and comment, to the Governor of each South Atlantic state a "Notice of Support Activity for the Exploration Program" (hereinafter called "Notice").

For the purpose of this stipulation South Atlantic states include North Carolina, South Carolina, Georgia, and Florida. The lessee shall not be required to include privileged information in this Notice. At his discretion, the lessee may submit either a separate Notice for each Exploration Plan submitted on a lease under 30 CFR 250.34, or a Notice for two or more Plans on one or more leases. The Notice shall not be subject to approval or disapproval by the Supervisor.

A copy of the Notice shall be submitted to the Supervisor no later than the date of submission of the Exploration Plan, with a certification that the Notice has already been submitted to the Governor of each South Atlantic state. A lessee who submits a Notice for two or more Exploration Plans shall not be required to supply additional copies of the Notice, but may instead refer to that prior submission. Before the Supervisor approves or disapproves the Exploration Plan, he shall allow at least 30 days from the date of receipt of the certification for the Governors to submit comments on the Notice to the lessee and supervisor. The Supervisor will give due consideration to the comments of the Governors in approving the Plans. Subsequent to submission of

the certification, significant changes in estimated support activities will be forwarded by the lessee, as an amendment to the Notice to the Governors of the South Atlantic states and the Supervisor.

The Notice shall include with respect to the lessee and his contractors:

(1) A description of the onshore and nearshore support facilities, including site, size, and timeframes expected to be constructed, leased, rented, or otherwise procured in affected areas;

(2) Amount and location of acreage expected to be required within the state for facilities, including the need for storage space for supplies;

(3) An estimate of the frequency of boat and aircraft departures and arrivals, on a monthly basis, and the possible onshore location of terminals;

(4) The approximate number of persons who are expected to be engaged in onshore support activities and transportation, and the approximate number of local personnel who are expected to be employed by or in the support of the exploration program;

(5) Estimates of the approximate addition to the population, on a county basis, due to the exploration program and the approximate number of persons needing housing and other facilities;

(6) An estimate of any significant quantity of major supplies, including water and energy, and equipment to be procured within the state; and

(7) The onshore address of the lessee's operation officers and of the contractors' offices involved in the exploratory operation.

In addition, the lessee shall make available to the Governor of the State adjoining the area under lease, or his designee, upon the request of the Governor or his designee, such shallow hazards data as may be obtained by the lessee, or his agent, during the course of any exploratory and/or development studies as may be conducted pursuant to the terms of this lease.

Evaluation

The provision relating to the Supervisor's handling of the comments by Governors' on the lessee's notice of support activity for exploration activity is subject to the comments under alternative stipulation No. 1. This matter involves the internal procedures of the Department in supervising lease activities and it is not appropriate to include such provisions in the lease contract between the Department and the lessee. The purpose of providing a 30 day period for such comments before approval of an exploration plan is to make them available for consideration by the responsible Departmental official before he approves or disapproves a plan. The appropriate course is to prescribe in the Department's supervisory procedures the details of the process involved in taking action on an exploration plan.

The requirement that shallow hazards data be made available to the Governor of a state adjoining the proposed lease area could provide such states with meaningful information with which to more completely assess the potential environmental impacts of OCS lease activities upon their coastal and nearshore areas. Such information could be useful to the states in conducting studies, facility siting activities and other planning activities under their respective coastal zone management programs, when approved.

The suggested alternative presents a serious problem in that it would require disclosure by the lessee of all shallow hazards data gathered in the stated activities. The problem arises because certain elements of this data would be proprietary in nature while other elements would be non-proprietary. And, before development of the data, it is not possible to precisely delineate the data which would categorically come within proprietary vs non-proprietary status.

The States would, upon request, be entitled to secure non-proprietary shallow hazards data. Proprietary data would not be subject to disclosure without the consent of the lessee. The States could, however, negotiate with the lessee to gain access to proprietary elements of that data.

Stipulation No. 5—Transport of Oil and Gas

The lessor reserves the right to determine whether oil produced pursuant to the terms of this lease will be transported to shore facilities by means of pipeline, barges, or other appropriate means. The lessor's decision regarding the selected means of an intergovernmental planning program for assessment and management of production and transportation of outer continental shelf oil and gas with the participation of Federal, State and local government and the industry. The lessee agrees that, when feasible, all pipelines, including both flow lines and gathering lines for oil and gas, shall be buried to a depth suitable for adequate protection from water currents, storm scouring, fisheries trawling gear, and other uses as determined on a case by case basis by the lessor or its designee.

The lessee further agrees that when this approved pipeline or lines have been completed pursuant to the terms of this lease, only in the event of an emergency shall the lessee resort to barges or other alternative means of transportation, and then only upon the approval of the lessor.

If the lessor determines that transportation by pipelines is not feasible, then the Supervisor, following consultation with other appropriate Federal and State officials will determine the most feasible alternatives including, but not limited to, barges and similar means of surface transportation. If the lessor determines that barge transportation is the most feasible alternative, the lessee agrees that no barges other than those specifically constructed to operate solely as a functionally integrated unit with tugs uniquely designed for use with this type of barge shall be employed in the transportation of oil and/or gas pursuant to the terms of this lease. The lessor further agrees that all barges operated pursuant to the terms of this lease will have sufficient ballast or cargo tanks aboard to assure the separation of ballast enroute from platform to terminal facility, and the ballast will be separate from cargo at all times.

EVALUATION

The suggested stipulation does not differ substantially from the recommended stipulation described in Section IV, except as to proposed design requirements for surface transportation of OCS production from the proposed lease area.

Since it is the Secretary of the Department in which the Coast Guard is operating, rather than the Secretary of the Interior, who has the authority to establish such standards, design requirements cannot be established in a lease stipulation in an Interior OCS oil and gas lease. The recommended stipulation provides that tankers used for the purposes referred to must conform to the standards prescribed by the Secretary of Transportation.

E. Additional Possible Scenarios of Development

The basic scenario incorporated into the discussion of impacts contained in Section III of this impact statement is described in Scenario D, Section III.E.1. That hypothetical development scheme incorporates the high resource estimates provided by the Geological Survey (Table C-1, Section I) as well as specified transportation systems and onshore locations for terminals, processing plants and operating bases as shown in Section I.

Although we would most likely expect such a pattern of development to take place from what is known today, other possible scenarios may occur. Events may be affected by future decisions dependent upon the quantity and location of resources that are found and by actions chosen by local and State governments in the course of their coastal zone planning. Due to uncertainty about the location and amounts of oil and gas that may be discovered, and in the event that permission to construct onshore facilities or to establish transportation routes for petroleum products across non-Federal jurisdiction is refused by one of the coastal states, modifications to the basic scenario discussed in Section I are examined also. We emphasize that the scenarios of development discussed hereunder are not alternatives to the proposed action that are available for selection by the decision maker. They are intended to present various patterns of development that could occur in given circumstances.

Tanker and barge movements from the Gulf Coast region to the East Coast region during the year 1975 included both crude oil and petroleum products. Data published in the Petroleum Statement, Annual (1975) provided the data summarized below.

The figures indicate a traffic amounting to approximately 65,000 barrels per day of crude oil and 1,266,380 barrels per day of petroleum products were carried by tanker and barge from the Gulf Coast region to the various Atlantic Coast regions. An additional 2.1 million barrels of domestic crude oil production was exported to the Virgin Islands during 1975.

Petroleum Administration for Defense (PAD) District No. 1 comprises the states located along the Atlantic seaboard. During the year 1975, approximately 576 million barrels of petroleum products were imported into PAD District No. 1, considerably below the approximately 754 million barrels imported during the year 1974.

During the year 1975, approximately 363 million barrels of petroleum products were imported into the U.S. from Central American and Caribbean points of origin, including 55.6 million barrels from the Bahamas, 148.4 million barrels from the Virgin Islands, and 32.7 million barrels from Puerto Rico. Most of these petroleum products consisted of residual fuel oil, gasoline, and distillate fuel oil.

Some consideration of these volumes in comparison to the estimated production rates anticipated from proposed Sale No. 43 are incorporated into the evaluation of the impacts anticipated from proposed Sale No. 43.

The daily crude oil production rates from proposed Sale No. 43 range from 56 to 170 thousand barrels per day, approximately 20 to 62 million barrels per year. This volume ranges from 1 to 3 times the volume of crude oil shipped from the Gulf Coast to the Atlantic Coast during 1975. The sale related estimates also range from 36 to 111% of the volume of petroleum products exported to the U.S. from the Bahamas, and compared to the total imports from Central American and Caribbean points, the sale related estimates range from 15 to 47% of this total.

The impacts associated with the existence of a new supply of crude oil along these present marine transportation routes, which were primarily located to supply the Atlantic coastal region with the supply of petroleum products required in the region, will depend on future economic conditions and industrial development. The various hypothetical scenarios presented herein were selected to illustrate a range of impacts that could occur given postulated future developments in the economic and political climate. They represent potential development scenarios to the base case (No OCS development; without refinery, Base I; or with refinery, Base II and III) incorporating changes in assumed conditions.

In a broad geographic sense, therefore, marine transportation of crude and refined petroleum products along the southeastern coast of the United States and between the Caribbean Islands does not depend solely on the activities stemming from proposed OCS Sale No. 43. However, existing facilities in the southeastern coastal states are oriented toward the receipt of refined products

and the scenarios incorporate assumptions regarding the location of facilities to locate, produce, and process crude resources.

1. Scenario A

Scenario A envisions an assumed operations base located in Chatham County, GA to provide support for all sale related drilling and production activities. In this scenario, it is assumed no gas would be produced or transported, and all produced oil would be gathered in an offshore storage and treatment facility and transported by tankers to refineries located outside the southeastern coastal region (i.e., in the Caribbean, Bahamas or Gulf of Mexico). The low resource estimate (Table C-1, Section I.) and the low level of development facilities are utilized.

The estimated sale related production of crude oil, if shipped to the Bahamas refinery for processing would probably displace an equivalent volume of crude oil obtained from other sources, and not result in increased tanker traffic adjacent to the islands. In the event that the crude oil was refined in other refineries, possible points of destination include the Gulf of Mexico, Puerto Rico and other Caribbean Islands, or refineries located along the central and northern portions of the Atlantic coastal states. Future crude oil sources may be located in the mid and north Atlantic regions, and the region's refinery requirements would probably be based on an arrangement that would minimize transportation costs; however, it is worthy of note that crude oil from the Gulf Coastal region in approximately the same quantities as the minimum estimated for proposed OCS Sale No. 43 shipped to the mid-Atlantic region during 1975. These quantities indicate that increased tanker transport of crude oil may be of minor significance compared to the continued transportation of petroleum products.

An alternative oil storage and transportation system that may be applicable to proposed OCS Sale No. 43 would be an offshore crude oil gathering and loading system. In the event that this system of crude oil handling were adopted, several different designs are proposed or have been placed in service. The reinforced "Cordeep" platforms constructed for North Sea operations, and the steel offshore storage tanks, known as "Khazzans" are in use at the present time. Other proposals consisting of "tension-leg" platform combined with a single point mooring buoy are under consideration.

The Final Environmental Statement prepared for the Proposed Plan of Development of the Santa Ynez Unit in the Santa Barbara Channel, off California, prepared by the United States Geological Survey (1974) disscusses a proposed offshore crude oil gathering, processing, and shipping facility as an alternative to pipeline transportation to an onshore facility, treatment, and subsequent tanker transportation to refining facilities. This alternative offshore facility consisted of a floating vessel of approximately 28,000 dwt displacement and a single anchor leg mooring system (SALM).

Natural gas produced with oil would be separated from crude oil on the production platform. Crude oil would be transported from the production platform to the single point mooring system, transferred to the floating vessel for treatment and storage, and transferred to a shuttle vessel for shipment to a refining center. Production facilities located on the floating vessel would separate emulsified water from the crude oil, and clean the water to appropriate standards for disposal into OCS waters. The proposed Santa Ynez facilities would have an initial design capacity of 40,000 barrels of oil per day.

Since the oil production levels estimated to result from proposed OCS Sale No. 43 range from 56,000 BOPD to 170,000 BOPD, between one and four installations of the proposed Santa Ynez installation capacity would be required for the proposed Sale 43, production levels. Or, alternatively, fewer installations of larger capacity might be required.

Each floating treatment and storage facility would have a capacity of 200,000 barrels of crude oil, and in the event of a complete loss of a floating vessel, approximately this volume of oil could be spilled. A collision with a floating vessel would probably result in a smaller volume of spilled oil, since compartments for storage would be provided on the vessel, and rupture of the outside tanks might result in a loss of between 3,200 and 6,200 barrels.

The locations of such floating processing and handling facilities cannot be specified prior to the discovery of production, but it appears probable that they would be located within the production areas designated by the Geological Survey (Appendix M), therefore, the oil spill trajectories computed for these production areas would be applicable to the trajectories of spills which may

originate from these offshore storage and treating facilities.

An oil spill of 37,500 barrels was considered in Appendix M, and a spill of this size represents approximately 19% of the capacity of a floating storage vessel, although considerably more volume than might be anticipated to result from collision.

A spill of 37,500 barrels, after 30 days at sea could be expected to affect a segment of shoreline approximately 40 miles in width, with residual oil ranging from approximately 10 gallons of oil per foot of shoreline to less than one half gallon per foot.

Scenario D incorporated into Section III of this statement included the assumption that crude oil produced from the sale area would be transported to onshore terminals by pipeline, and shipped to refining centers by means of tanker transport.

This optional method for treating, storage, and transporting crude oil implies the same level of tanker transport as discussed in Scenario D. The principal variation from Scenario D is the storage of crude oil and the transfer of crude oil to tankers at points located between 35 miles and 60 miles offshore. In the event that a refinery would be constructed within the four state area, and this method of handling the crude oil produced from the proposed sale area were adopted, tanker transport from the producing area to the refinery would be undertaken. With reference to Figure 1, Appendix M, spills originating at points A, B, and C would be applicable in this case.

IMPACTS OF SCENARIO A

The impacts that would be expected to be associated with this alternative are generally the same as those described in Section III of this statement with the following exceptions:

Beaches

The impact on beaches as a result of Scenario A would differ from that of the original proposal in two ways. There would be no pipeline landfall; therefore, the beach environment would be spared the disruption created by pipeline construction and burial. However, offshore transfer to tankers may increase the tarring of beaches thereby creating an increased potential for a negative aesthetic impact.

The oil spill trajectory model (Appendix M) treats the trajectories of spills that might result from production points. Offshore storage facilities would be located in the vicinity of one or more of these hypothetical points.

Wetlands

The impacts on wetlands as a result of Scenario A might differ from that of the original proposal in two ways. The absence of pipelines would prevent such adverse effects as disruption of marsh vegetation, salt-water intrusion, accelerated runoff and increased tidal exchange, which would potentially reduce marsh productivity. Also, fewer operations bases would result in less impact on wetland areas.

Onshore Water Quality

Due to the planned increase in sewage treatment facilities, Scenario A would not cause water quality impacts differing from the impacts discussed in Section III. However, the construction of an operations base would result in local, short-term increases in turbidity and siltation in localized streams and estuaries in Georgia.

Onshore Air Quality

Air quality deterioration under Scenario A would be significantly less since there is no gas processed in onshore facilities. Also, the projected increase in population, construction activities, and transportation would be less (see Section III.D.6.).

ECONOMIC FACTORS

Employment

The peak employment associated with Scenario A is 2,682 by the year 1984, which is considerably less than the maximum employment of 7,818 associated with the Scenario D examined in Section III.

Population

The peak population associated with Scenario A is 5,321 in the year 1984, compared to 22,111 in the year 1988. This is a significant decrease in population to be expected from the development.

Income

Per capita income is estimated to increase by a maximum of $12 per capita per year in Scenario A, compared to $15 per year in Scenario D. The total increased personal income amounts to $50 million, compared to $141 million in Scenario D.

CUMULATIVE IMPACTS OF SCENARIO A

In the event that exploratory drilling resulting from proposed Sale 43 is successful, additional

offerings of acreage in the vicinity of the tracts offered during proposed Sale No. 43 would result.

Increased production of oil and gas would increase the impacts that could be anticipated beyond those estimated to result from a single lease offering, and result either in a greater level of impacts or impacts over a larger time span. The quantitative value of these impacts cannot be determined at the present time, since the areal extent of oil and gas resources has not been established.

2. Scenario B

Scenario B incorporates the low resource estimates provided by the Geological Survey (Table C-1, Section I.). An operations base is located in Chatham County, GA. Crude oil is transported to shore via pipeline to a terminal in Duval County, FL and then transhipped by tanker to existing refineries in other areas, such as the Caribbean, Mid-Atlantic, or Gulf of Mexico.

Natural gas would be assumed to be transported by pipeline to processing facilities in Charleston County, SC.

Impacts of Scenario B

The impacts that would be associated with Scenario B are as follows. All impacts not specifically mentioned are believed to be about the same as described in Scenario D, Section III.

Transportation

Fewer tanker trips would be required for transporting the reduced crude oil resources incorporated in Scenario B, only approximately 28% of the trips expected in Scenario D.

Land Use

These impacts would be less in Scenario B due to fewer facilities required and reduced population impacts.

Beaches

Due to the lower number of tanker trips required by the lower resource estimates, smaller amounts of residue oil would be present on the beaches than are discussed in Scenario D.

Wetlands

If we assume that all construction resulting from Scenario B was to occur on filled wetland, then as a maximum, 20 ha (50 acres) in Chatham County, GA; 16 ha (40 acres) in Duval County, FL; and 8 ha (20 acres) in Charleston County, SC would be required. The effect would be a lesser impact on wetlands than would be caused by Scenario D.

Onshore Water Quality

The gas processing facility envisioned under this alternative could lead to a significant degradation of the water quality in localized areas of Charleston County, SC by bringing about the construction of such auxiliary facilities as chemical and plastic plants. However, the impact under Scenario B would be less than described in Scenario D.

Onshore Air Quality

The reduction in the number of gas processing plants by one (Duval County, FL) means that the impacts of Scenario B are about 50% lower than those discussed in Scenario D. A gas processing plant could increase SO (below line) levels by 2 to 5% and NO (below line) by 9 to 22% in a given locality.

Economic Factors

Employment

The maximum employment associated with Scenario B amounts to 1999 by the year 1996, significantly below the estimated 7,818 in the year 1988 projected for Scenario D examined in Section III.

Population

The maximum population associated with Scenario B amounts to 3,540 in the year 1984, compared to 22,111 in the year 1988 for the Scenario D.

Income

The maximum income effect associated with Scenario B amounts to $10 per capita in the year 1996 compared to $15 per capita in the year 1988 as discussed in Scenario D. Increased total personal income amounts to $42 million, compared to $141 million in Scenario D. Employment, population and per capita income changes would likely be smaller in Scenario B.

Cumulative Impacts of Scenario B

In the event that exploratory drilling undertaken as a result of this proposal was successful, additional offerings of leases would probably result. In this event, the cumulative impacts that would result from this initial proposed sale would be greater than those evaluated for this proposed offering. These increased impacts could take the form of an increased level of impacts or a continuation of impacts over a longer period of time.

3. Scenario C

Scenario C assumes the location of an operating base at Chatham County, GA; pipeline transportation of crude oil from the producing area to a terminal in Glynn County, GA, and overland pipeline transportation to a refinery in Chatham County, GA. Natural gas would be assumed to be transported via pipeline to Charleston County, SC for processing. Scenario C is also based on the low resource estimates provided by the Geological Survey (Table C-1, Section I.).

IMPACTS OF SCENARIO C

The impacts associated with Scenario C are about the same as those discussed in Section III (Scenario D) with the following exceptions.

Onshore Water Quality

The operation of a refinery in Chatham County, GA would lead to a small increase in local water pollution effects.

Onshore Air Quality

The operation of a refinery in Chatham County, GA would likely lead to increased air quality deterioration in the event that crude oil with higher sulfur levels was processed. Also, increased amounts of particulates, hydrocarbons, and other pollutants would result.

Transportation

Fewer tanker trips would be required for transporting the reduced crude oil resources incorporated in Scenario C.

Beaches

Scenario C would probably have the same or lesser effects due to the smaller quantities of resources, than was described in Section III.

Wetlands

In addition to impacts described in Section III, wetlands could be impacted further by Scenario C due to the overland pipeline from Glynn County to Chatham County, GA.

Land Use

Land use impacts related to this alternative would probably be lower than those discussed in Section III, due to the smaller number of facilities required and the lower increase in population. The hypothetical oil refinery would also imply a land use committed to crude oil processing.

ECONOMIC FACTORS

Employment

The maximum employment associated with Scenario C amounts to 1,843 persons in the year 1984, compared to 7,818 persons in the year 1988 in Scenario D.

Population

The maximum population impact associated with Scenario C amounts to 3,380 persons, a significant reduction from the estimated 22,111 persons estimated in Section III.

Income

The maximum increase in income associated with Scenario C amounts to about $9 per capita, considerably less than the $15 per capita forecast in Section III. The estimated additional personal income amounts to approximately $35 million annually, compared to approximately $141 million annually in Scenario D.

CUMULATIVE IMPACTS OF SCENARIO C

In the event that the exploratory drilling related to this proposed sale was successful, additional offerings of leases would probably be made in the vicinity of proposed Sale No. 43. In this event, additional drilling activity, additional platforms and additional transportation facilities would be required. This activity could take several forms, an increase in the level of activity or the carrying out of a given level of activity over a longer period of time. In any event, an additional impact statement will be prepared prior to subsequent lease offerings.

4. Scenario E

Scenario E incorporates the high resource estimates provided by the Geological Survey (Table C-1, Section I). The principal difference between the assumptions incorporated in Scenario E and those included in Section III (Scenario D) is the existence of a hypothetical petroleum refinery in Chatham County, GA. An oil pipeline terminal is assumed for Chatham County, GA and gas terminals are located in Glynn County, GA and Charleston County, SC rather than Duval County, FL and Charleston County, SC.

IMPACTS OF SCENARIO E

The impacts that would be expected to be associated with Scenario E are generally the same as those described in Section III of this impact statement with the following exceptions.

Transportation

The presence of a hypothetical refinery with pipeline transportation of the crude oil for processing reduces the number of pipelines and the requirements for tanker transportation of crude petroleum below that estimated in Section III.

Onshore Air Quality

The total adverse impact on air quality due to gas processing is the same, however, a different location has been assumed for one of the plants, Glynn County, GA. The presence of the hypothetical refinery in Chatham County would cause more adverse impacts locally than are estimated in Section III, Scenario D.

Onshore Water Quality

The presence of an oil refinery would probably increase the adverse impact on water quality at localized sites in Chatham County.

Beaches

The impacts of this alternative would probably not differ from those described in Section III.

Wetlands

If the hypothetical refinery is located near wetlands, the productivity of this ecosystem could be reduced by the effects of refinery effluents.

Land Use

The lower population levels associated with Scenario E suggest lower demand for residential land and housing, but the presence of the refinery implies a commitment of land to oil processing facilities above that contained in the discussion in Section III.

ECONOMIC FACTORS

Employment

The maximum increase in employment estimated under Scenario E is 5,903, less than the 7,818 persons estimated in Section III.

Populations

The maximum increase in population estimated for Scenarion E is 15,570, less than the 22,111 persons estimated in Section III.

Income

The maximum increase in income amounts to $17 per year per person compared to $15 per year per person estimated in Section III. The total maximum annual increase in personal income amounts to $113 million, compared to $151 million in Section III.

CUMULATIVE IMPACTS OF SCENARIO E

In the event that exploratory drilling resulting from this proposed sale is successful, additional lease offerings in the vicinity of proposed Sale No. 43 will probably ensue. The existence of a petroleum refinery hypothesized in this Scenario E would probably serve as a destination point for oil production that might be obtained from Sale No. 43 and subsequent sales. In this event, several of the facilities, such as the refinery, gas processing plants, and the onshore terminals would be utilized for the transportation and processing of resources from more than one sale. This implies an exposure of other resources to oil spills for a period longer than the time estimated for this single sale, and a commitment of land to petroleum related uses for a longer period of time.

5. Scenario GASC

Scenario GASC employs the high resource estimates provided by the Geological Survey. Operations bases, gas processing facilities and oil terminals were located in Camden and Glynn Counties, GA and Charleston County, SC. A refinery was postulated in Chatham County, GA (Base Case II) or in Jasper County, SC (Base Case III). The pipeline routes, both marine and overland, are approximately indicated by the locations of the onshore terminals and refineries (Base II Glynn County to Chatham County, GA; Base III Charleston County to Jasper County, SC). Gas processing plants were hypothesized to be constructed in Glynn County, GA and Charleston County, SC. Scenario GASC, when compared to Base II and Base III, postulates the construction of a refinery in Chatham County, GA or Jasper County, SC either South or North of the Savannah River, in the general area northwest of the City of Savannah.

IMPACTS OF SCENARIO GASC

Transportation

The impacts of Scenario GASC are considered to be the same as the impacts discussed in Section III of this impact statement with the exception of the increased onshore land use that would be associated with the requirements for overland pipelines to the postulated oil refinery. The use of pipeline transportation to a refinery located within the area would reduce the likelihood of oil spills

resulting from barge and tanker transportation to refineries outside of the region for processing.

Onshore Air Quality

The location of a gas processing facility in Glynn County, GA rather than Duval County, FL, would have a potential adverse impact on the air quality in that region. The presence of an oil terminal in Glynn County could also lead to adverse impacts on air quality.

Onshore Water Quality

The construction of facilities could cause some deleterious impact on water quality during the construction phase. The presence of an onshore terminal in the Glynn County area could lead to impairment of water quality.

Land Use

The operations base postulated for Camden County, GA would probably permit the use of existing underutilized facilities. The presence of a refinery in Chatham County, GA or Jasper County, SC implies a commitment of land for refinery use, and residential and commercial construction.

ECONOMIC FACTORS

Scenario GASC was compared to the three base cases (I, II, and III) which projected future conditions in the region in the absence of development in the Outer Continental Shelf. The principal difference between the assumptions incorporated into the base cases were the presence of and location of a refinery. The economic effects resulting from the assumptions incorporated into Scenario GASC varied depending on the base chosen.

Employment

The changes in civilian employment range from approximately 7,500 to 8,900 depending on the choice of assumptions incorporated into the base cases, compared to approximately 7,800 in Scenario D (Base I) discussed in Section III.

Population

The changes in population range from approximately 22,900 to 25,100 depending on the choice of assumptions incorporated into the base cases, compared to approximately 22,111 in Scenario D (Base I) discussed in Section III.

Income

The per capita increase ranges from $9 to $18 depending on the choice of base cases, compared to $15 in Scenario D (Base I) discussed in Section III.

CUMULATIVE IMPACTS OF SCENARIO GASC

The existence of a general purpose petroleum refinery in the southeastern U.S. would probably be a major destination point for crude oil production that may be found on the South Atlantic OCS, and could have significant impact on marine transportation of petroleum. To the extent that the entire capacity of this refinery could be met with OCS produced crude oil, from proposed Sale No. 43 and subsequent sales, the refinery could induce additional activity on the OCS. This could involve a trade-off, the impacts of increased OCS production, described in Section III of this statement, contrasted to the potential for spills associated with transport to shore, transportation to a refinery, and transportation of refined products into the area for consumption. In the event that a refinery was put into operation in the area, some efficiencies in distribution of the products, implying decreased marine transportation, would probably result.

6. Scenario NC-I

Scenario NC-I is generally the same as Scenario D with the exception that the operations, both exploratory and development, include an operations base in New Hanover County, NC. Scenario NC-I incorporates the assumption that should available facilities in other areas be insufficient to support the postulated activities, some broader geographical dispersion of activities may result.

IMPACTS OF SCENARIO NC-I

Transportation

The principal impact of Scenario NC-I would be an increased level of marine traffic in New Hanover County, NC, with decreased amounts of traffic estimated for Glynn County, GA and Duval County, FL.

Land Use

The lower population impact associated with Scenario NC-I implies a lower demand for land for residential and commercial uses than the level estimated in Scenario D discussed in Section III. However, land requirements in North Carolina would be increased.

Onshore Water Quality

In the event that construction was required for facilities in New Hanover County, NC some temporary impairment of water quality would result

ECONOMIC FACTORS

Employment

The civilian employment effects associated with Scenario NC-I provide for the employment of approximately 6,700 persons compared to approximately 7,800 persons in Scenario D evaluated in Section III.

Population

The population increase projected for Scenario NC-I amounts to approximately 16,000 persons compared to approximately 22,111 in Scenario D evaluated in Section III.

Income

The per capita income effect associated with Scenario NC-I amounts to $33 compared to $15 in Scenario D evaluated in Section III.

CUMULATIVE IMPACTS OF SCENARIO NC-I

In the event that the proposed operating base in New Hanover County, NC proved to be favorably located for the support of further OCS operations, continued use of the facility could result. This would maintain the increased level of sale induced civilian employment in North Carolina for a longer period than that computed for the proposed Sale No. 43.

7. Scenario SC MAX-I

In the event that approval could not be obtained from Federal, State, or local authorities for the shipment of crude oil or natural gas to the destination points specified in the discussion of impacts included in Section III of this statement. Scenario SCMAX-I considers the possibility that all of the facilities specified in Section III were constructed in the State of South Carolina. Scenario SCMAX-I also incorporates an assumption that a refinery will be constructed within the state at a time subsequent to the proposed sale. Scenario SCMAX-I could result from a refusal on the part of the authorities mentioned above to permit the construction of OCS related facilities in Florida, Georgia, or North Carolina; whereas the construction of these facilities is acceptable within the jurisdiction of the State of South Carolina.

IMPACTS OF SCENARIO SCMAX-I

Land Use

The principal impact associated with Scenario SCMAX-I is the increased civilian employment attributed to South Carolina compared with other scenarios. An additional factor is the location of an operations base in Georgetown County, SC. Gas processing facilities are hypothetically located in Charleston and Georgetown Counties, and a refinery is postulated for the Charleston area.

Onshore Air Quality

The presence of a gas processing plant in Georgetown County may have an adverse impact on air quality in this region, but diminished impact on the air quality in Duval County, FL, one of the locations specified in Section III.

Since the high resource estimates were incorporated in Scenario SCMAX-I, the other impacts are probably the same as those discussed in Section III, with the exception of specific geographical locations.

ECONOMIC FACTORS

Employment

The employment effects computed for Scenario SCMAX-I amount to an increase of approximately 5,600 persons compared to approximately 7,800 persons in Scenario D discussed in Section III.

Population

The population effects for Scenario SCMAX-I amount to an increase of approximately 14,000 compared to 22,111 in Scenario D, discussed in Section III.

Income

The per capital income change amounts to $18 compared to $15 in Scenario D, discussed in Section III.

CUMULATIVE IMPACTS OF SCENARIO SCMAX-I

The postulated conditions incorporated into Scenario SCMAX-I which imply landing points, processing plants and a refinery would tend to cause the area to serve as a focal point for additional OCS operations in the event that oil and gas production is found as a result of proposed Sale No. 43. In the event that continued operations ensued from the proposal, the cumulative impact could take several forms. The most probable is seen to be a continuation of the employment levels reached as a result of the initial sale, with operations extending for a longer period of time.

8. Scenario FMAX-I

In the event that approval could not be obtained from Federal, state or local authorities for

the shipment of crude oil or natural gas to the destination points specified in the discussion of impacts included in Section III of this statement, Scenario FMAX-I considers the possibility that all of the facilities specified in Section III were constructed in the State of Florida. Scenario FMAX-I also incorporates an assumption that a refinery will be constructed in Duval County, FL, serving an area larger than the county. This refinery would be constructed following the date of the proposed sale. Scenario FMAX-I could result from a refusal on the part of the authorities mentioned above to permit the construction of OCS related facilities in North Carolina, South Carolina, or Georgia; whereas, the construction of these facilities is acceptable within the State of Florida.

IMPACTS OF SCENARIO FMAX-I

Land Use

Scenario FMAX-I would require additional land in Florida to be commited to OCS related uses during the period that oil and gas from this proposed sale was produced.

Onshore Air Quality

The location of terminals, gas processing facilities, and a hypothetical refinery in Florida imply a greater impact on air quality within this state than was incorporated into the discussions of impact in Section III.

ECONOMIC FACTORS

Employment

The employment computed for Scenario FMAX-I amounts to approximately 7,100 compared to 7,800 computed for Scenario D analyzed in Section III.

Population

The estimated increase in population under Scenario FMAX-I amounts to approximately 15,900 compared to 22,111 computed for Scenario D analyzed in Section III.

Income

The per capita income effect amounts to $26 compared to $15 in Scenario D discussed in Section III.

CUMULATIVE IMPACTS OF SCENARIO FMAX-I

The postulated conditions incorporated into Scenario FMAX-I which imply landing points, processing plants, and a refinery would tend to cause the area to become a focal point for OCS oil and gas related processing, transportation, and support activity.

Successful exploration as a result of OCS Sale No. 43 would probably lead to additional sales and development on the OCS, and in this eventuality, the existence of the facilities in Florida, would probably imply continued use, and resulting continued employment.

9. Scenario NCMAX-I

In the event that approval could not be obtained from Federal, state, or local authorities for the shipment of crude oil or natural gas to the destination points included in Section III of this statement, Scenario NCMAX-I considers the possibility that all of the facilities specified in Section III were constructed in the State of North Carolina. This scenario also incorporated an assumption that a refinery will be constructed within the State at a time subsequent to the proposed sale. Scenario NCMAX-I could result from a refusal on the part of the authorities mentioned above to permit the construction of OCS related facilities in Florida, Georgia, or South Carolina; whereas the construction of these facilities is acceptable within the jurisdiction of the State of North Carolina.

IMPACTS OF SCENARIO NCMAX-I

Land Use

The principal impact associated with Scenario NCMAX-I is the increased civilian employment attributed to North Carolina compared with Scenario D. Civilian employment in North Carolina amounts to 6,221 during the year 1988 compared to approximately 57 in Scenario D. This change implies a greater commitment of land resources for residential and commercial uses during the period of development.

The location of a refinery, operations bases, and gas processing plants in New Hanover County, NC would require a greater commitment of land to petroleum oriented activities than was discussed in Section III of this statement.

Onshore Air Quality

The presence of two gas processing facilities in New Hanover County, NC probably signifies that air quality impacts in this region will be greater than those discussed in Section III of this statement.

Transportation

Increased crew boat and support vessel traffic originating in New Hanover County, NC would result from Scenario NCMAX-I.

Economic Factors

Employment

The estimated increase in employment amounts to approximately 6,700 persons in Scenario NCMAX-I, compared to approximately 7,800 persons in Scenario D discussed in Section III.

Population

The estimated increase in population amounts to approximately 12,800 compared to an estimated 22,111 in Scenario D discussed in Section III.

Income

The estimated per capita income effect amounts to $33 compared to $15 in Scenario D discussed in Section III.

Cumulative Impacts of Scenario NCMAX-I

The postulated conditions incorporated into Scenario NCMAX-I which imply landing points, processing plants and a refinery would tend to cause the area to serve as a focal point for additional OCS operations in the event that oil and gas production was found as a result of proposed Sale No. 43. In the event that continued operations ensued from the proposal, the cumulative impact could take several forms. The most probable is seen to be a continuation of the employment levels reached as a result of the initial sale, with operations extending for a longer period of time.

10. Scenario GMAX-I

In the event that approval could not be obtained from Federal, state or local authorities for the shipment of crude oil or natural gas to the destination points specified in the discussion of impacts included in Section III of this statement, Scenario GMAX-I consider the possibility that all of the facilities specified in Section III were constructed in the State of Georgia. Scenario GMAX-I also incorporates an assumption that a refinery will be constructed within the State at a time subsequent to the proposed sale. Scenario GMAX-I could result from a refusal on the part of the authorities mentioned above to permit the construction of OCS related facilities in North Carolina, South Carolina, or Florida, whereas the construction of these facilities is acceptable within the jurisdiction of the State of Georgia.

Impacts of Scenario GMAX-I

The principal impact associated with Scenario GMAX-I is increased civilian employment in Georgia of approximately 5,800 persons compared to approximately 1,500 persons in Scenario D. This increased employment implies a greater commitment of land resources to the support of OCS related facilities than Scenario D.

Alternative areas have been hypothesized for the locations of oil related activity such as Camden County, GA for an operations base and gas processing plant, and a refinery located in Glynn County. All of these hypothetical locations imply land uses that are different than those discussed in Section III.

Onshore Air Quality

The location of a refinery in Glynn County, and gas processing plants in Camden and Glynn Counties imply that air quality in these areas may be impacted more than was estimated to be the case in Scenario D discussed in Section III.

Transportation

The presence of an oil refinery implies the development of a transportation system for distribution of the products, and this might result in additional lines or water routes to existing distribution facilities.

Economic Factors

Employment

The employment associated with Scenario GMAX-I amounts to approximately 6,100 persons compared to approximately 7,800 persons in Scenario D discussed in Section III.

Population

The change in population associated with Scenario GMAX-I amounts to approximately 17,700 compared to approximately 22,111 in Scenario D discussed in Section III.

Income

The per capita income effect amounts to $14 compared to $15 in Scenario D discussed in Section III.

Cumulative Impacts of Scenario GMAX-I

The postulated conditions incorporated into Scenario GMAX-I which imply landing points, processing plants, and a refinery, would tend to cause the area to serve as a focal point for additional OCS operations in the event that oil and

gas production is found as a result of proposed Sale No. 43. In the event that continued operations ensued from this proposal, the cumulative impact could take several forms. The most probable is seen to be a continuation of the employment levels reached as a result of the initial sale, with operations extending for a longer period of time.

Section 9

Consultation and Coordination with Others

A. Preparation of the Draft Environmental Statement

1. Federal Agencies

Numerous Federal agencies were contacted for information and suggestions throughout the environmental assessment and statement preparation process.

Federal agencies contacted include:

- **Department of Agriculture**
  - Forest Service
  - Soil Conservation Service
- **Department of Commerce**
- **National Oceanic and Atmospheric Administration**
  - Marine Ecosystems Analysis Program (MESA)
  - National Data Buoy Center
  - National Marine Fisheries Service
  - National Oceanographic Data Center
  - National Weather Service
  - Office of Coastal Zone Management
- **Department of Defense**
  - U.S. Army Corps of Engineers
  - U.S. Air Force
  - U.S. Navy
    - Commander Eastern Sea Frontier
    - Naval Oceanographic Office
- **Department of the Interior**
  - Bureau of Mines
  - Bureau of Outdoor Recreation
  - Fish and Wildlife Service
  - Geological Survey
  - National Park Service
- **Department of Transportation**
  - Federal Aviation Administration
  - Office of Pipeline Safety
  - U.S. Coast Guard
- **Environmental Protection Agency**
  - Region III
  - Region IV
  - Office of Research and Development
- **Federal Energy Administration**
- **Federal Power Commission**
- **National Aeronautics and Space Administration**

2. State and Local Governments

In May, 1975, a letter from the BLM New Orleans OCS Office was sent to the Governors' designated contacts in the Southeast Atlantic States, requesting data and information regarding key state programs and resources. These requests were followed by direct requests to specific State agencies and visits to various agencies to collect information.

During the last quarter of 1975 and first quarter of 1976 personal contacts were made with selected county governments and regional planning commissions, requesting information on land use plans and critical environmental areas. Subsequent requests were made to these agencies asking for population, socio-economic and other pertinent information.

Continued liaison with state agencies has been maintained. In some cases, contact and information has been provided through a single State agency serving as a clearinghouse for all data requests and input. In other cases, the New Orleans OCS Office contacted individual state agencies each time information or input was needed. The process followed in each case was that requested by the individual or agency named by the respective Governor to coordinate with the New Orleans OCS Office regarding OCS activities. Meetings were held with representatives of one or more agencies of the Southeast Atlantic states as a group (exclusive of conferences regarding environmental baseline studies) on three occasions: June 25-26 and July 1, 1975. These meetings were arranged to discuss the scope, assessment procedures, data needs, and coordination mechanisms with regard to the environmental impact statement. A working draft of the Description of the Environment (Section II) was circulated to State agencies for review. In September, 1976, preliminary drafts of the DES were sent to State agencies for review. In all cases, the DES was a working version, for which identification of data omissions, errors, and suggestions for completeness were requested. Subsequent to review by the States, staff members of the BLM New Orleans OCS Office travelled to the States to discuss suggestions and problems identified by each of the States.

Contacts through BLM-sponsored meetings, meetings at the State level, and direct solicitation of information were made to numerous State and local governmental agencies, including, but not limited to those listed below.

- **State Agencies**
  - North Carolina
    - Department of Administration
    - Department of Agriculture
    - Department of Conservation and Development
      - Division of Marine Fisheries
      - Division of Commercial and Sport Fishers
    - Department of Human Resources
      - Division of Health Services
    - Department of Natural and Economic Resources
      - Division of Archives and History
      - Division of Environmental Management
      - Division of Parks and Recreation
      - Division of Resource Planning
    - Office of Intergovernmental Relations
    - Office of State Planning
    - State Budget Office
    - State Geological Survey
    - State Ports Authority, Morehead City, N.C.
    - Wildlife Resources Commission
  - South Carolina
    - Department of Archives and History
    - Department of Environmental Quality

- Solid Waste Management Division
- Division of Air Quality Control
- Department of Health and Environmental Control
- Division of Industrial Waste Water
- Department of Parks, Recreation and Tourism
- Department of Wildlife and Marine Resources
- Division of Wildlife and Freshwater Fisheries
- Disaster Preparedness Agency
- Division of Administration
- Division of General Services
- Employment Security Commission
- State Board for Technical and Comprehensive Education
- State Development Board
- Geology Division
- Research Division
- Highway Department
- Tax Commission
- Water Resources Commission

Georgia
- Attorney General's Office
- Coastal Area Planning and Development Commission
- Department of Community Development
- Department of Natural Resources
- Coastal Fisheries Office
- Earth and Water Division
- Environmental Protection Division
- Game and Fish Division
- Historical Preservation Office
- Land Protection Division
- Marshland Protection Division
- Office of Planning and Research
- Parks and Recreation Division
- Resource Planning
- Department of Transportation
- Georgia Ports Authority
- Georgia State Archaeologist
- State Geological Survey
- Office of Planning and Research

Florida
- Bureau of Coastal Zone Management
- Department of Administration
- Division of State Planning
- Department of Commerce
- Department of Legal Affairs
- Department of Natural Resources
- Division of Recreation and Parks

3. Professional and Industry Firms and Associations, Academic Institutions, Public Interest Groups, and Others

In May, 1975, a letter was sent from the BLM New Orleans OCS Office to the many agencies and offices in the Southeast Atlantic region explaining that the Office was commencing work on an environmental assessment for the purpose of preparing an environmental impact statement on proposed OCS Sale No. 43. Interested parties who felt that they could contribute input to the draft environmental statement were invited to designate a contact and indicate interest.

In the course of the environmental assessment and draft statement preparation process, numerous agencies, companies, individuals and institutions were contacted for information.

In September, 1976, at the time when invitations were extended to State and Federal agencies to review the working draft of the DES, groups which had at some time expressed an interest in providing input into the statement were invited to review the working draft.

Institutions, associations and groups which were contacted for information or input include, but are not limited to the following:

Academic Institutions

North Carolina
- Duke Marine Laboratory, Beaufort, N.C.
- Duke University, Geology Department, Durham, N.C.
- North Carolina State University, Raleigh, N.C.
- University of North Carolina, Chapel Hill, N.C.
- Department of Marine Science
- Research Laboratory of Anthropology

South Carolina
- University of South Carolina
- Belle W. Baruch Institute for Coastal Research
- Department of Biology
- George D. Grice Marine Biological Laboratory, Charleston, S.C.
- Institute of Archaeology and Anthropology
- School of Engineering
- School of Geology

Georgia
- Institute of Technology, Atlanta, Ga.
- Office of Interdisciplinary Programs
- University of Georgia, Athens, Ga.
- Institute of Community and Area Development
- Marine Extension, Brunswick, Ga.
- Skidaway Institute of Oceanography, Savannah, Ga.
- Institute of Natural Resources

Florida
- University of Florida, Gainsville

Industrial Firms
- API Production Subcommittee
- New England Petroleum Company
- Offshore Operators Committee

Public Interest Groups
- South Carolina Audubon Society, Columbia, S.C.
- South Carolina Wildlife Federation
- Florida Audubon Society
- Marine Mammal Commission

Others
- Coastal Plains Regional Commission

4. Coordination With Federal and State Agencies and Other Groups in the South Atlantic Coastal State Pertaining To Proposed Lease Sale No. 43

Dates	Location	Agency	Contact	Topic
6-25-75	Columbia, S.C.	Meeting with representatives of S.C.	Ed Richardson et al.	Explained total leasing process and
6-26-75	Atlanta, Ga.	Meeting with representatives of Ga.	Gary Midkiff et al.	solicited State contacts
7-1-75	Atlanta, Ga.	Meeting with S.E. Field Committee	June Whelan	OCS leasing process
7-2-75	Raleigh, N.C.	Meeting with representatives of N.C.	Stepehn Conrad et al.	OCS leasing process & solicited contacts.
7-9-75	Miami, Fla.	National Ocean.Data Center	J.C.Sylvester,et al.	Coordination 43 and data exchange
		National Hurricane Center	C.J.Neuman, et al.	for proposed Sale 43
9-2-75	Columbia, S.C.	S.C.State Geologist	N.K.Olson, et al.	"
9-3-75	Columbia, S.C.	Univ. of S.C.-Geo.Dept.	Dr. Nummedal,et al.	"
		Seismologist	P. Talwani	
		Engineering	Dr. Baker	
		Bell W. Baruch Inst.	F.J. Vernburg	
		Geology & Mar Sci.	B. Kjerfve	
9-4-75	Columbia, S.C.	S.C. Div.Gen. Services	P.H.Infinger	"
		S.C. Pet. Council	W.F.Ross	
		S.C. Disaster Prepard.	F.C.Craft, et al.	
		S.C. State Dev.Board	M. Treadwell	
		S.C. Research & Stat. Ser.	T.P.Evans	
9-5-75	Charleston, S.C.	S.C. Wildlife & Marine Res. Dept.	M. Shealy, Jr.	"
			C. Barans	
		USFWS	C.A. Laffin	
9-8-75	Atlanta, Ga.	Ga.State His.Officer	D.Sherman	"
		Parks & Rec. Div.	T.H. Massey, Jr.	
9-9-75	Atlanta, Ga.	Ga.State Archeol.	L.Larson	"
		Game & Fish	Ed.Carlson	
		Office Plan & Res.	C. Parrish	

Dates	Location	Agency	Contact	Topic
9-10-75	Atlanta, Ga.	Ga. Dept.Nat.Res.	L. Dean	Coordinate 43
9-16/17-75	New Orleans, La.	S.C.Gov. Representative briefing on #43	Col. Whitmire	OCS Leasing Process
9-22-75	Raleigh, N.C.	Dept. of Nat. Res.	Boyd Derane, et al.	Air/Water Qual. Marine Affairs
9-23-75	Brunswick,Ga.	Ga. Game/Fish Div.	Larry Smith David Gould	Biol.Ocean. Comm. & Sport Fisheries
9-24-75	Atlanta, Ga.	State Water Quality State Air Quality EPA	Karen Scott William Estes Albert Hendron,et al.	Water Quality Air Quality Air/Water Qual.
9-24-75	Savannah, Ga.	Skidaway Institute	David Menzel	Biol. Ocean.
9-27-75	Myrtle Beach,S.C.	S.C.Marine Instit.		Biol. Ocean.
9-28-75	Charleston, S.C.	S.C.Marine Res. Div.	Charles Bearden Charles Barans	Biol. Ocean.
9-29-75	Beaufort, N.C.	NMFS	Gene Huntsman,et al.	Comm. & Sport Fisheries
9-30-75	Columbia, S.C.	S.C.Development Board	M.Treadwell	Coordination 43
		S.C.Tax Commission	C.Brooks	
		S.C. Div. of Admin.	H.E.Henn	
9-30-75	Columbia, S.C.	S.C.Plann & Dev. S.C. Dept. Parks/Rec. S.C.Archives Hist. Inst. of Arch/Anth.	W.R.Jennings R.L.Gunter J.Cliff A.Albright	Coordination and data exchange for proposed Sale No. 43
	Charleston,S.C.	Marine Res.Center	M. Copeland	"

Dates	Location	Agency	Contact	Topic
10-1-75	Raleigh, N.C.	N.C. Arch/Hist. N.C. Res./Plann. N.C. Land Use Plan. N.C.Soil Scientist N.C. Parks/Recr. N.C. Div. Recr. N.C. Off.of Intergovern. Relations N.C.State Budg.Off. N.C. State Plann.Off.	L. Tise S. Conrad M. Sullivan D. Philen R. Johnson J.E.Laydon Frank Crawford Ms.Burleson L.Muchmore R. Gray	Coordination and data exchange for proposed Sale No. 43
10-2-75	Raleigh, N.C.	N.C.Ports Authority	C.P.Lynch	"
10-3-75	Raleigh, N.C.	N.C.Dept.of Nat.Res.	B. Jamieson	"
10-3-75	Wilmington, N.C.	Wilmington Dist. Corps of Eng.	L. Sanders	"
10-27/30-75	Savannah, Ga.	Eastern States Meet. At Skidaway		
11-14-75	Atlanta, Ga.	1st Tract Sel. Meet. w/Fed. State Person.	4 S.Atlantic States	Tract Selection Proposed Sale 43
12-4-75	Atlanta, Ga.	2nd. " " "	"	"
1-15/16-76	Charleston, S.C.	Meeting with S.A. States, FWS-USGS NMFS-EPA		"Live Bottom" drill muds & cuttings, and pipelines
3-29-76 thru 4-1-76	New Orleans, La.	Hands On Seminar for S. Atl. States		
4-24-76	Tallahassee,Fla.		J.Jones, et al.	Review visuals
4-25-76	Atlanta, Ga.	Ga. Dept. of Nat. Res.	Lillian Dean,et al.	Review visuals
4-26-76	Columbia, S.C.		Ed Richardson,et al.	Review visuals
4-27-76	Raleigh, N.C.	N.C.Dept. of Nat. & Econ. Res.	Steve Conrad, et al.	Review visuals
	Charleston, S.C.	S.C.Wildlife & Mar. Res.	Charles Barans	"Live Bottom" coordination
5-4-76	Columbia, S.C.	Manager Addressed S.C. Water Res. Conf. on leasing procedures		OCS Leasing procedures

Date	Location	Agency	Contact	Topic
9-9-76	Atlanta, Ga.	Ga. Dept. Nat. Res.	Lillian Dean, et al.	Coordination and data exchange for proposed Sale 43
		Ga, Dept. Highways		Trans. Informa.
10-4/6-76	Cocoa Beach, Fla.	S.E. Field Comm. Meeting		OCS Leasing Process
10-4-76	New Orleans, La.	St. of Ga. Represen.	G. Midkiff, et al.	Harris Model
10-6-76	New Orleans, La.	St. of Fla. Represen.	J. Jones, et al.	Harris Model
		St. of S.C. Represen.	Ed Richardson et al.	
10-6-76	Savannah, Ga.	Skidaway Institute	Jim Henry	Review side scan sonar data
10-8-76	Atlanta, Ga.	S. Atlantic Reg. OCS Advisory Comm.		Baseline studies
10-12-76	Gulf Breeze, Fla.	EPA	Norm Richards	Drilling muds
10-13-76	Pensacola, Fla.	Bionomics	Rod Parish	Drilling muds

Date	Location	Agency	Contract	Topic
10-16-76	Charleston, S.C.	S.C. Wildlife & Mar. Res. Dept.	C. Barans T.W. Custer, FWS J.B. Kirkwood D.W. Woodard OBS	Coordination 43 Wading bird rookeries
10-18-76	Atlanta, Ga.	U.S. Natl. Park Ser.	Mirt Ingham, et al.	Coordination and data exchange for proposed Sale 43
10-19-76	Atlanta, Ga.	USFWS, S.E. Reg. Off.	Phiester, et al.	"
10-19-76	Atlanta, Ga.	U.S. Forest Ser. So. Reg.	Jack Wolf	"
		Ga. Dept. Nat. Res. Recreation Planning	Britt Pendegast, et al.	"
10-20-76	Atlanta, Ga.	Bur. of Outdoor Rec. S.E. Reg. Office	Graham Lewis, et al.	"
		Corps of Eng. S. Atl. Division	Frank McGovern, et al.	"
10-28-76	Atlanta, Ga.	BLM-FWS Meeting	K. Black J. Kirkwood	"
12-7/8-76	Wilmington, N.C.	N.C. St. Water Qual. Control Board	A.C. Turnage, et al.	Water Quality
12-8-76	Jacksonville, Fla.	Mgr. Meet. with S.E. States on Stipulations		Stipulations Proposed Sale 43
12-8-76	Savannah, Ga.	Skidaway Inst.	Jim Henry	Review data from USGS S.A. cruise
12-26-76	Brunswick, Ga.	Ga. Dept. Nat. Res.	Fred Marland	Review visuals
	Columbia, S.C.	Univ. of S.C.	Bjorn Kjerfve	Review visuals
1-12/15-77	Tampa, Fla.	FWS U. of Miami Mar. Mammal Comm.	Blair Elsner John Reynolds, et al. Twiss-Hoffman	Marine mammals Coordination 43
2-14-77	Raleigh, N.C.	N.C. Dept. of Nat. & Econ. Res.	S. Conrad	Deliver DES 43
2-15-77	Charleston, S.C.	S.C. Water Res. Comm.	Ed Richardson	"
2-16-77	Atlanta, Ga.	Ga. Off. of Plan/Budgt.	G. Midkiff	"
3-22-77	Atlanta, Ga.	S. Atl. Reg. Bd. Meeting		Coordination 43 Stip. & OCS Ord.

Date	Location	Agency	Contact	Topic
4-29-77	Atlanta, Ga.	2974 Agencies & Ga. & S.C.	G. Midkiff Ga. Larry Smith Lewis Larson Dottie Wilson Dave Swanson Lowell Evjen Ed Richardson S.C. FWS, GS, NPS	Coordination 43 Stipulation
3-28/29-76	Savannah, Ga.	Public Hearing #43		
3-31 & 4-1-77	Charleston, S.C.	Public Hearing #43		
4-29-77	Atlanta, Ga.	#43 Stipulation meeting w/states, GS, FWS, NPS		
5-12-76	Atlanta, Ga.	Asst. Mgr. Addressed Ga. Conservancy on Program		OCS Leasing process
5-25-76	Atlanta, Ga.	Mgr. Addressed S.E. Regional OCS Advisory Committee on Pipelines		Pipeline permitting procedures
5-28-76	Atlanta, Ga.	Review biol/archae. Stipulations with S.E. Region USGS, FWS, NPS		Coordination and data exchange for proposed Sale 43
6-17-76	New Orleans, La.	API & OOC Committee Meeting		Input DES 43 Harris Model
6-20/29 76	Port Everglades, Fla.	USGS	William P. Dillon	Geophysical research S.E. Embayment
7-24/25-76	Jones Beach, Fla.	Florida Dept. of Nat. Res.	E.A. Joyce FDNR H.R. Bullis, NMFS C.A. Laffin, FWS	Sea turtle coordination 43
9-8-76	Savannah, Ga.	Skidaway Inst.	George F. Oertel Atkinson J. Henry	Review of pre-DES 43 Review visuals
		Savannah Ports Auth.		Trans. Informa.

5. Review of the Preliminary Draft Environmental Impact Statement

The four South Atlantic States: North and South Carolina, Georgia and Florida were invited to review the working draft of the draft environmental impact statement for the purposes of identifying any errors and omissions, or making any suggestions for completeness prior to the draft statement's submission to the Washington BLM headquarters office for formal review and submission to the Council on Environmental Quality.

6. Coordination and Review of the Draft Environmental Statement Leading to Preparation of the Final Environmental Statement

A. Coordination during the review of the Draft Environmental Statement

The draft environmental statement was filed with the Council on Environmental Quality on February 16, 1977. A notice of its availability was published in the Federal Register on the same day. Approximately 1500 copies of the two-column draft statement were distributed to Federal, state and local agencies, U.S. Congressmen, state officials, industry representatives, libraries, conservation and environmental groups, and others. Comments were requested concerning the draft environmental impact statement and the proposal, and were to be submitted by April 15, 1977.

B. Public Hearings

Two public hearings were held in Savannah, Georgia on March 28 and 29, 1977, and Charleston, South Carolina on March 31, and April 1, 1977.

The purpose of these hearings was to receive views, comments and suggestions relative to the environmental impact statement and the proposed action as part of the OCS accelerated leasing program. Charles C. Moore, Administrative Law Judge from the Department of the Interior's Office of Hearing and Appeals, Arlington, Virginia, conducted the hearings. A panel of officials representing the Secretary's Office, U.S. Department of the Interior, Bureau of Land Management, the U.S. Geological Survey, the U.S. Fish and Wildlife Service and the National Park Service received the testimony.

At the conclusion of each person's testimony, if desired, members of the hearing panel questioned the witness to clarify or expand their testimony.

Total oral testimony at the public hearings was given by 41 persons in Savannah, Georgia and 32 persons in Charleston, South Carolina. Complete official transcripts of the public hearings plus written comments received are available for public inspection at the Bureau of Land Management in the New Orleans Outer Continental Shelf Office, in New Orleans, Louisiana and in Washington, D.C.

Eighty witnesses presented oral statements and 22 submitted written statements for a total of 102 statements.

Of those statements, 5 expressed that the DES was adequate while 10 expressed that it was inadequate. The remaining witnesses expressed no opinion as to the adequacy of the DES.

Fifty-six of the statements indicated that the lease sale should proceed as scheduled, whereas 16 witnesses stated that the lease sale should be delayed.

Reasons given for a delay of the sale included the absence of a national energy policy (mentioned 5 times), the absence of Coastal Zone Management Plans, (9), inadequate environmental studies (3), and revisions required in the DES (2).

Concern was voiced over the present handling of lease stipulations and S.O. 2974. Eight witnesses mentioned at least some aspect of this problem and four of these were official representatives of the States within the planning area.

Other major concerns expressed were the need for a national energy policy (6 witnesses), the hearings were insufficiently publicized (8), and the need for an EIS between exploration and production (6).

Public Hearing Log, Proposed OCS Sale No. 43

March 28, 1977, Savannah, Georgia

1. Norman L. Underwood, Executive Sec. to Governor of Georgia, State of Georgia.
2. Stan Hecker, Asst. Director, Office of Marine Affairs, State of North Carolina.
3. Lewis H. Larson, Jr., State Archaeologist, State of Georgia.
4. Donald Turk, Exec. Director, Florida Farm Bureau Federation.
5. David Young, President, Savannah Area Chamber of Commerce.
6. William M. Myers, T. F. Hart, Dr. E. W. Erickson, API.
7. Charles D. Mathews, Pres., National Ocean Industries Assoc.
8. Capt. R. E. Salman, Secretary, Council of American Master Mariners, Inc.
9. Peter G. Smith, Interstate National Gas Association, Merle Air, American Gas Assoc.
10. Margaret Muller, Ogeechee Audubon Society.
11. Joe T. La Boon, President, Atlanta Gas Light Co.
12. Albert Bradford, Himself.
13. Miriam R. Heltner, Herself.
14. Albert Scardino, Margaret Muller.
15. Geraldine Le May, Chairman, Natural Resources Commission, League of Women Voters.
16. Walter Beaseley, Himself.
17. Robert A. Nelson, Exec. Dir., Jacksonville Beaches Area, Chamber of Commerce.
18. Larry Smith, Himself.
19. Penn Worden, Jr., Exec. V.P., Georgia Chamber of Commerce.
20. Richard S. Trogdon, Sierra Club.
21. Dr. Charles Schutt, Pres., Jacksonville Offshore Fisherman's Club.

March 29, 1977, Savannah, Georgia

1. Charles F. Blair, Exec. Asst., Florida Commissioner of Agriculture.
2. Hans Neuhauser, Director, Coastal Office, Georgia Conservancy.

3. Paul E. Hoffert, President, Propellor Club of the U.S.
4. William Newburn, Sales Mgr., Jacksonville Shipyards.
5. Ellen Winchester, Bob Owens, Sierra Club.
6. Dr. Larry Atkinson, O. J. Shirley, Dr. Richard F. Lee, API.
7. M. C. Peterson, Mgr. Public Affairs, Gilman Paper Co.
8. Capt. Jerome G. Benyo, Asst. Marine Supt., U.S. Lines, Inc.
9. James W. Dunlap, Brooklyn Union Gas.
10. O. D. Mullinax, Asst. Commissioner, Georgia Dept. of Agriculture.
11. E. H. Morgan, S. E. Fisheries Assoc.
12. E. W. Mertens, Chevron Research.
13. Shirley Owens, Herself.
14. Vernon Martin, Lorraine Deusenbury, Coastal Area Planning and Development Commission
15. John Rousakis, Mayor, City of Savannah.
16. Dr. Robert Smith, (3-28) State of Florida.
17. Fred Nadelman, Himself.
18. Ben Hubby, M.D., Savannah's Silent Majority.
19. James Farrell, Himself.
20. Albert Scardino, Himself.

March 31, 1977, Charleston, S.C.

1. William D. Workman, Exec. Asst. to the Governor, State of Georgia.
2. Jacqueline E. Jacobs, Exec. Sec., South Carolina Wildlilfe Federation.
3. Vice Admiral Douglas C. Plate, Charleston Trident Chamber of Commerce.
4. Joe Walter, Dr. David Hould, API.
5. Suzanne M. Seymour, Jacques Costeau Society.
6. William Jennings Bryan Dorn, Himself.
7. John G. Riddich, S. Carolina Chamber of Commerce.
8. Alys Anne Patterson, Herself.
9. Frances Bienecke, Nat. Res. Defense Council.
10. W. N. Ackerman, V.P., S.C. Electric and Gas Co.
11. Kenneth A. Rogers, Himself.
12. Verona Knisely, Charleston County, League of Women Voters.
13. Robert W. Bybee, Operations Mgr., Exxon Corp.
14. Peter Eldridge, Common Cause, South Carolina.
15. Dr. Donald J. Colguhoun, Dr. Michael E. Bender, API.

April 1, 1977, Charleston, S.C.

1. Terry L. Miller, V.P., Banker's Trust of S.C.
2. Thomas E. Thornhill, Pres., S.C. Oil Jobbers Assoc.
3. Sen. Harold W. Hardison, N.C. Energy Policy Council.
4. Dr. Leo W. Jenkins, Chancellor, East Carolina Univ.
5. Robert D. Jenkins, Chrmn., N.C. Highway Users Conference.
6. Thompson Greenwood, Exec. V.P., N.C. Merchant Assoc.
7. Mote V. Griffity, Jr., Exec. Director, Better Transportation for North Carolina, Inc.
8. John W. Sledge, Pres., N.C. Farm Bureau Federation.
9. Ormond Barbee, Chrmn., Onslow County.
10. Samuel Boylston, Gen. Mgr., Motor Transportation Assoc. of S.C.

March 28, 1977, H.R. only

1. F. E. Autrey, Exec. V.P., Florida Power and Light Company.
2. Kinney S. Harley, Exec. Dir., Florida Home Builders Assoc.
3. William S. Lee, Exec. V.P., Duke Power Company.
4. Joe B. Cox, Gold Kist Inc.
5. Nathan Garser, Sr., Cartaret County Commissioners.
6. Carroll Lance, Exec. Dir., Asphalt Contractors Assoc. Florida.
7. Gene Dyson, Pres., Georgia Business and Industry Assoc.
8. Gordon Campbell, Pres., Exchange Bancorporation, Inc.
9. H. W. Wendt, Getty Oil Co.
10. R. H. Smith, American Assoc. of Petroleum Landmen.
11. F. C. Roberts, Jr., Pres., North Carolina Oil Jobbers Assoc.
12. Steven E. McWilliams, Ga. Assoc. Mineral Producing Industries.

April 1, 1977, Charleston, S.C.

1. Sheri Maier, Trident 2000.
2. Sen. Allen Carter, Jr., Joint Legislative Committee to Study Oil and Gas.
3. Paul Hammer, Coor. Operations, Institute of Merchant Shipping.
4. Alex Harvin, Jr., Chairman, S.C. Highway Users Conference.
5. Robert E. Coleman, Pres., S.C. Textile Manufacturers Assoc.
6. Jack Paylor, V.P., Piedmont Natural Gas Co.
7. Gary Lamberson, S.C. Environmental Coalition.
8. James E. Harrington, Himself.
9. Joe Sandlin, Natural Gas Industry.
10. Kathryn Livingston, Herself.
11. Charles Flowers, Himself.
12. Herbert Jacobs, Himself.
13. Nancy Chirich, LeCompte Chapter, Sierra Club.
14. Larry Thompson, Natl. Audubon Society.
15. Gen. William Van Harlingen, S.C. Advisory Board Member.

C. Written statements submitted for public hearing

In addition to comments received at the public hearings, approximately 63 written comments were received as a result of solicitation by news releases, Federal Register notices, distribution of the draft statement, and in connection with the public hearing.

Fifty-four of these letters were in support of the offshore oil and gas leasing program off the South Atlantic. Five letters indicated opposition or delay and three neither supported nor opposed the proposed lease sale.

Reasons for opposition or delay of the sale were: 1) this sale would cause destruction to the coast line as have similar operations along the California coast; 2) increased investigation of the area and its resources must occur before leasing is allowed.

Two noncommittal letters indicated that there was not enough advertising of the public hearings, the hearings were held at an inconvenient time, and more information concerning cultural resources should be reported during the exploration for oil and gas reserves.

Written statements received in response to the Public Hearings

Date Received

Agency, Organization or Individual

3-9-77 Atlantic National Bank of Jacksonville; Jacksonville, FL; A. C. Sinclair

3-14-77 Motor Transportation of South Carolina, Inc.; Columbia, SC; S. L. Boylston

3-17-77 Getty Oil Company; Houston, TX; H. E. Wendt

3-17-77 Exchange Bancorporation, Inc.; Tampa, FL; G. W. Campbell

3-21-77 Asphalt Contractors Association of Florida, Inc.; Tallahassee, FL; Carroll Lance

3-21-77 Carteret County Board of County Commissioners; Beaufort, NC; Nathan Garver, Sr.

3-21-77 Georgia Association of Mineral Producing Industries, Inc.; Atlanta, GA; S. E. McWilliams

3-21-77 Georgia Business & Industry Association; Atlanta, GA: Gene Dyson

3-23-77 American Association of Petroleum Landmen; Ft. Worth, TX; R. H. Smith

3-23-77 North Carolina Oil Jobbers Association; Raleigh, NC; F. C. Roberts, Jr.

3-24-77 Gold Kist, Inc.; Atlanta, GA; Phil Campbell

3-25-77 Florida Home Builders Association; Tallahassee, FL; K. S. Harley

3-25-77 Duke Power Company; Charlotte, NC; W. S. Lee

3-25-77 Florida Power & Light Company; Miami, FL; J. H. Francis, Jr.

3-28-77 Jacksonville Offshore Sport Fishing Club; Jacksonville, FL; C. E. Schutt

3-28-77 Greater Rock Hill Chamber of Commerce, Rock Hill, SC; C. R. Carpenter, Jr.

3-28-77 Georgia Travel Commission; Atlanta, GA; Spurgeon Richardson

3-28-77 Greater Tampa Chamber of Commerce; Tampa, FL; Louis Benito

3-28-77 National Automobile Dealers Association; McLean, VA; W. E. Hancock, Jr.

3-28-77 Seaboard Coast Line Railroad Company; Jacksonville, FL; D. C. Hastings

3-28-77 Onslow County; Jacksonville, NC; T. M. Roach

3-29-77 Van E. Estes, Jr.; Richmond Hill, GA.

3-29-77 Bert A. Cunkelman; Ormond Beach, FL.

3-30-77 Jacksonville Port Authority; Jacksonville, FL; J. J. Scott, Jr.

3-31-77 Senator H. E. Talmadge; Washington, D.C.

4-1-77 Bill Mankin; Atlanta, GA.

4-1-77 Associated Industries of Florida; Tallahassee, FL; J. L. Shebel

4-1-77 Transcontinental Gas Pipe Line Corporation, Houston, TX; R. D. Stanwood

4-1-77 Lewis H. Larson, Jr.; Carrollton, GA.

4-4-77 Sonoco Products Company; Hartsville, SC; J. B. Boyd

4-4-77 F. E. Weltz; Tampa, FL.

4-4-77 South Carolina Oil Jobbers Association; Columbia, SC; T. E. Thornhill

4-4-77 Department of Natural Resources, Atlanta, GA; D. J. Carter

4-4-77 Florida Gas Company; Winter Park, FL; R. Y. Patterson, Jr.

4-6-77 Carol N. Vincent; Savannah, GA.

4-6-77 Sierra Club; San Franscisco, CA; Ellen Winchester

4-7-77 Ed. Scott; Tampa, FL.

4-8-77 Thomas S. Mundorff, Brandon, FL.

4-8-77 Propeller Club of the United States; Tampa, FL; W. O. Savage

4-8-77 Alma Exchange Bank; Alma, GA; Valene Bennett

4-11-77 Gulf Energy and Mineral Company; New Orleans, LA; B. L. Choate

4-11-77 South Carolina Farm Bureau Federation; Columbia, SC; H. S. Bell

4-11-77 Grice Marine Biological Laboratory; Charleston, SC; W. D. Anderson, Jr.

4-11-77 Southern National Bank; Lumberton, NC; J. E. Sandlin

4-13-77 Jim Sexton, Inc.; Orlando, FL; J. J. Sexton

4-13-77 W. R. Giles; Jacksonville, FL.

4-13-77 Florida Chamber of Commerce; Tallahassee, FL; R. S. Spencer, Jr.

4-13-77 Goins Equipment & Motor Service; Kissimmee, FL; R. H. Goins

4-13-77 Offshore Operators Committee; New Orleans, LA; R. C. Vanbiber, Jr.

4-14-77 Walter F. Hannaway, Jr.; Tampa, FL.

4-15-77 Senator Strom Thurmond; Washington, DC

4-15-77 Florida Highway Users Federation; Orlando, FL; Wayman Singleton

4-15-77 Coastal Georgia Audubon Society; Brunswick, GA; J. H. Walters

4-15-77 California Polytechnic State University; San Luis Obispo, CA; F. H. Oelschig

4-15-77 Florida Public Service Commission; P. F. Hawkins

4-18-77 Public Service Electric & Gas Company; Newark, NJ; R. I. Smith

4-18-77 College of Charleston; Charleston, SC; T. S. Stern

4-18-77 Alys A. Patterson; Mount Pleasure, SC

4-18-77 City of Jacksonville; Jacksonville, FL; H. G. Tanzler, Jr.

4-18-77 Albert Bradford; Savannah, GA

4-18-77 Lewis A. Taylor, Jr.; Savannah, GA

4-21-77 L. H. Collins; Tampa, FL

4-21-77 South Carolina Service Station Dealers Association, Inc.; Charleston, SC; W. T. Bryant

4-21-77 Georgia Highway Users Conference; Atlanta, GA; Leroy Logsdon

D. Written comments received on the draft environmental statement

A list of written comments received on the Draft Environmental Statement on proposed Outer Continental Shelf Oil and Gas Lease Sale Offshore South Atlantic (OCS Sale No. 43).

Written Comments Received on Draft Environmental Statement

Date Received
Agency, Organization or Individual

2-28-77 Nuclear Regulatory Commission

3-11-77 Bureau of Mines

3-11-77 Applied Management Science, J. J. Owen

3-17-77 Federal Power Commission

3-25-77 University of North Carolina, Dirk Frankenburg

3-28-77 Cape Fear Council of Governments, Wilmington, N.C.

3-29-77 South Carolina Department of Archives and History

3-31-77 Mid-East Commission, Washington, D.C.

4-7-77 Endangered Species Productions, Phoebe Wray

4-8-77 Environmental Protection Agency

4-11-77 Southeast Georgia Area Planning and Development Commission, Waycross, Ga.

4-14-77 Ivan Teper, Atlanta, Ga.

4-15-77 State of Georgia, Office of Planning and Budget and Department of Natural Resources

4-15-77 Florida Department of Natural Resources

4-15-77 Ben Hubby, Savannah, Ga.

4-15-77 Department of Health, Education, and Welfare

4-15-77 American Institute of Merchant Shipping, Washington, D.C.

4-15-77 Fish and Wildlife Service

4-18-77 Natural Resources Defense Council, Inc., New York, N.Y.

4-18-77 National Park Service

4-18-77 North Carolina Department of Administration

4-19-77 Sierra Club, Joseph LeConte Chapter, Raleigh, N.C.

4-19-77 Geological Survey

4-19-77 Florida Audubon Society

4-19-77 Columbia Gas System Service Corporation, Wilmington, Delaware

4-20-77 Bureau of Outdoor Recreation

4-22-77 Florida Department of Administration

4-22-77 Department of State

4-25-77 Department of Commerce

4-26-77 State of South Carolina

4-27-77 Department of Transportation, Coast Guard

4-27-77 Department of Defense

5-5-77 Department of the Army, Corps of Engineers

5-6-77 Marine Mammal Commission

E. Review and analysis of comments received

All comments and letters received were first reviewed relative to either corrections and editorial changes to the draft statement or issues raised. Where possible and appropriate, the environmental statement has been revised to correct errors and omissions, and to clarify and/or augment discussion of issues of concern. All substantive issues were analyzed to determine revisions necessary to strengthen and improve upon the draft statement. Wherever possible, the final statement reflects consideration given to these issues.

This section contains letters to the Governors of the four states: Governor Edwards, South Carolina; Governor Busbee, Georgia; Governor Askew, Florida; and Governor Hunt, North Carolina. These letters address the comments that were raised concerning departmental policy. It also contains a list of issues and responses which are organized according to section. The final portion of this section contains copies of correspondence received from Federal and state agencies, and other representative organizations, individuals and groups regarding the draft impact statement and the proposed action.

Dear Jim:

This is in response to your letter of April 19, 1977, transmitting the State of South Carolina's review comments on the Draft Environmental Statement (DES) for OCS Sale No. 43. My intent is to respond to your comments which deal primarily with program or policy issues. Those comments which deal more specifically with the DES will be published and responded to in the Final Environmental Statement.

First, you request that tracts not be added to the list of proposed sale tracts subsequent to the final tract selection agreement without the involvement of State officials, and that you be consulted prior to the deletion or withdrawal of tracts from a sale. Please be assured that one of my primary considerations in revising the OCS Planning Schedule, which has been recently released, was to more fully consider the interests and concerns of State and local governments. In following the new schedule, there will be close coordination with you or your representatives prior to making any major decisions in the leasing process.

You also expressed concern over the special stipulations to be attached to leases in the sale area. These stipulations deal with the protection of biological and cultural resources and transportation methods. Representatives of the Bureau of Land Management, as well as other Departmental representatives, have met with representatives of your State on several occasions to discuss planned stipulations. Although State and Departmental differences have not been resolved at these meetings, we shall continue working toward agreement. I may want to change the stipulations during the period between the publishing of the FES and the Notice of Sale if new information so warrants. For this reason, it is not appropriate to state that the version of the lease stipulations in the FES is an irreversible commitment. However, you will be consulted before I make a final decision on whether or not to proceed with the sale and the lease terms and conditions which would apply.

Another concern addressed the issue of pipeline locations. The Bureau of Land Management is

currently developing a Pipeline Management Program. A basic assumption of this program will be the full involvement of affected coastal States.

The final concern was that of the availability of data from our environmental studies. Every reasonable effort will be made to provide you with information from these studies as expeditiously as practicable. I would also refer you to the responses in the FES to the more detailed comments on the DES regarding the environmental studies program.

The administrators and scientists within your State organization have been most helpful and cooperative during the planning process for this proposed lease sale and their technical comments on the draft environmental impact statement have been addressed in the final statement. We in the Department of the Interior sincerely appreciate your interest in our energy development program and we trust that we can continue to foster the attitude of openness and cooperation which has been evidenced by your State.

If you have any further concerns or wish additional information on the Department's policy, please do not hesitate to contact me personally. Through such interactions as described above, it is our aim to provide your State with an active role in the decisionmaking process.

Sincerely,

/s/ CECIL D. ANDRUS
Secretary

DEAR GEORGE:

The State of Georgia's comments on the Draft Environmental Statement (DES) for the Proposed Outer Continental Shelf (OCS) Oil and Gas Lease Sale No. 43 were transmitted to us by Mr. Lowell Evjen's letter of April 19, 1977. As was noted in that letter, these comments are concerned not only with the DES for Sale No. 43 but also with the OCS oil and gas program in general. This letter will attempt to answer those of your comments which deal with programmatic or policy issues, while the remainder of your comments will be responded to in the final environmental statement itself.

One of your major concerns is that OCS oil and gas leasing should take place in the context of a national energy policy. The development of our Nation's oil and gas resources on the OCS is a vital aspect of our national energy program. The revised OCS Planning Schedule, announced on May 17, 1977, reflects our efforts to proceed with the OCS program in a way which will ensure timely development of these resources while providing adequate protection of the environment and incorporating State and local concerns in the planning process.

Secondly, you express concern that the OCS oil and gas program take place in the context of a national oceans use policy. This Department intends to conduct OCS oil and gas leasing in a manner which minimizes conflicts with other uses of the OCS and adverse impacts on our other valuable ocean resources. This is evidenced by our consultation with all Federal agencies involved with ocean use programs or regulations prior to oil and gas leasing. Lease stipulations, OCS Operating Orders, and Notices to Lessees and Operators are all designed with consideration of other ocean uses in mind.

You also endorse the concept of preparing supplemental environmental impact statements (EIS's) subsequent to exploration on the OCS. This is, as you suggest, a reasonable course of action. I have directed that development stage EIS's be prepared for the North and Mid-Atlantic sale areas. I have decided that a development stage EIS will be prepared for the South Atlantic area as well. This will provide for a more site-specific, detailed environmental assessment of both onshore and offshore activities, and will give State and local authorities more information needed for planning purposes.

You have expressed great concern over the special stipulations to be attached to leases in the sale area. These stipulations deal with the protection of biological and cultural resources and transportation methods. Representatives from the Bureau of Land Management have consulted with your representatives on several occasions to discuss planned stipulations; the latest such review occurred on May 24, 1977, in Washington, D.C. I view the participation of your State in the development of these stipulations as a necessity, and I will make every effort to ensure your continued involvement. It may be necessary to make changes in the stipulations during the period between this meeting and the publication of the Notice of Sale, if new information so warrants. For this reason, it is not appropriate to state that the version of the lease stipulations in the final

environmental impact statement represents an irreversible commitment by the Department, although you will be consulted should any further changes be necessary.

In this same vein, you request that the Notices to Lessees which would implement the stipulations be published in the final statement. Due to the original nature of the intent of a Notice, that is to allow emergency regulatory measures, I suggest that the stipulations be made comprehensive enough to satisfy your concerns without having to involve changes in our policy on the Notices to Lessees. We will solicit your review of those Notices which are not of an emergency nature.

An additional concern was that of the relationship between our environmental studies and OCS development planning. I agree fully that the information from these studies should be applicable to and useful for decisionmaking. Currently, our environmental studies are undergoing review by the National Academy of Sciences, the Office of Technology Assessment, the Outer Continental Shelf Environmental Studies Advisory Committee, and an in-house Bureau of Land Management evaluation. These reviews should produce the elements necessary for a more effective studies program.

The administrators and scientists within your State organization have been most helpful and cooperative during the planning process for this proposed lease sale. Their technical comments on the draft environmental statement will be addressed in the final statement. We in the Department of the Interior sincerely appreciate your interest in our energy development program and we trust that we can continue to foster the attitude of openness and cooperation which has been evidenced by your State.

If you have any further concerns or wish additional information on the Department's policy, please do not hesitate to contact me personally. Through such interactions as described above, it is our aim to provide your State with an active role in the decisionmaking process.

Sincerely,

/s/ CECIL D. ANDRUS

Secretary

DEAR REUBIN:

This letter is in response to the comments submitted by the State of Florida on the Draft Environmental Statement (DES) for the Proposed Outer Continental Shelf (OCS) Oil and Gas Lease Sale No. 43. I would like to take this opportunity to respond to those comments in your submission which concern programmatic or policy issues while assuring you that the remainder of your comments dealing more specifically with the DES will be responded to and published in the final environmental statement (FES).

The primary concern noted in your State's comments was that the OCS leasing should take place in the context of a national energy policy. The revised OCS Planning Schedule for the leasing program, which I announced on May 17, 1977, is intended to place the OCS oil and gas program in such a context, permitting this Nation to reduce its dependence on insecure and costly imports, while providing for closer cooperation and consultation with the affected States in carrying out the OCS energy development program.

You also suggest that supplemental environmental statements be prepared between the exploration and production phase of oil and gas activity. It has been decided for OCS Sale Nos. 40 and 42 to prepare an environmental statement at the development plan stage of oil and gas activity. It is my determination that this is the best course to follow for Sale No. 43 also. Once exploration has defined the amount and location of oil and gas resources, an environmental impact statement (EIS) could more effectively assess the site-specific environmental consequences of development and provide the State and local governments with more precise information for planning purposes.

You also expressed concern over the special stipulations to be attached to leases in the proposed sale area. These stipulations deal with the protection of biological and cultural resources and transportation methods. Representatives from the Bureau of Land Management have offered to meet with your representatives on several occasions to discuss planned stipulations. One such review by the concerned South Atlantic States occurred on April 29, 1977, in Atlanta, Georgia. A subsequent meeting was held on May 24, 1977, to discuss the final wording of the stipulations. However, I must reserve the right to change the stipulations should the availability of new information

warrant prior to the publication of the Notice of Sale. For this reason, it is not appropriate to state that the version of the lease stipulations in the final environmental statement is an irreversible commitment, although you will be consulted should any further comments be necessary.

The administrators and scientists within your State organization have been most helpful and cooperative during the planning process for this proposed lease sale and their technical comments on the draft environmental statement have been addressed in the final statement. We in the Department of the Interior sincerely appreciate your interest in our energy development program and we trust that we can continue to foster the attitude of openness and cooperation which has been evidenced by your State.

If you have any further concerns or wish additional information on the Department's policy, please do not hesitate to contact me personally. Through such interactions as described above, it is our aim to provide your State with an active role in the decisionmaking process.

Sincerely,

CECIL D. ANDRUS
Secretary

DEAR JIM:

This letter is in reply to your comments on the Draft Environmental Statement (DES) for OCS Sale No. 43. It is my intent in this letter to respond to your comments which concern program or policy issues. Detailed comments submitted by your State specific to the DES will be responded to and published in the final environmental statement (FES).

One of your concerns is that the States should be closely involved in the planning for energy development on the OCS. On May 17, 1977, I announced a new OCS Planning Schedule which is intended to help this Nation to reduce its dependence on insecure and costly foreign imports, while providing for closer cooperation and consultation with the affected States in carrying out the OCS energy development program. While carrying out this new Planning Schedule, we will work closely with you with regard to the OCS oil and gas program in the South Atlantic area.

You also expressed concern over the special stipulations to be attached to leases in the sale area. These stipulations deal with the protection of biological and cultural resources and transportation methods. Representatives of the Bureau of Land Management, as well as other Departmental representatives, have met with representatives of your State on several occasions to discuss planned stipulations. Although State and Departmental differences have not been resolved at these meetings, we shall continue working toward agreement. I may want to change the stipulations during the period between the publishing of the FES and the Notice of Sale if new information so warrants. For this reason, it is not appropriate to state that the version of the lease stipulations in the FES is an irreversible commitment. However, you will be consulted before I make a final decision on whether or not to proceed with the sale and the lease terms and conditions which would apply.

The administrators and scientists within your State organization have been most helpful and cooperative during the planning process for this proposed lease sale and their technical comments on the draft environmental impact statement will be addressed in the final statement. We in the Department of the Interior sincerely appreciate your interest in our energy development program and we trust that we can continue to foster the attitude of openness and cooperation which has been evidenced by your State.

If you have any further concerns or wish additional information on the Department's policy, please do not hestitate to contact me personally. Through such interactions as described above, it is our aim to provide your State with an active role in the decisionmaking process.

Sincerely,

/s/ CECIL D. ANDRUS
Secretary

Issues Concerning Description of Proposal

Issue No. B-1: The State of South Carolina met with representatives of BLM and USGS during the tract selection process to assist in the evaluation of specific tracts for inclusion in the recommendations for consideration by the Secretary of the Interior. Numerous tracts were added to the proposed sale tracts which had not been discussed with State officials. This type of action tends to disrupt the working rapport and confidence State officials have with regional representatives of the Federal Government.

Raised by: State of South Carolina

Response: There appears to be some misunderstanding with respect to discussions held with coastal States' officials in connection with the tentative selection of tracts for environmental study of a proposed OCS oil and gas lease sale offshore the South Atlantic States (Proposed OCS Sale No. 43). We believe a brief review of the Department's coordination activities with affected coastal States, and the latter's participation in the tentative tract selection process, will prove useful.

Representatives of the coastal States adjacent to the area proposed for OCS oil and gas lease sale no. 43, including the State of South Carolina, were invited and attended two meetings scheduled by the New Orleans OCS Office, Bureau of Land Management, regarding tentative selection of tracts for further environmental study in connection with a potential OCS lease sale offshore the south Atlantic States (Proposed OCS Sale No. 43). Representatives of the States referred to above presented their views and suggestions with respect to the tracts under consideration. These meetings preceded the submission on January 6, 1976, of the BLM-GS joint field recommendation as to tracts to be tentatively selected.

Representatives of these States were also invited and attended a meeting at the Washington Office level of BLM and GS preceding the recommendation of March 10, 1976, from the Director, BLM, to Secretarial level officers of the Department, relative to tentative selection of tracts. The State representatives presented their views regarding tentative selection of tracts that were jointly recommended BLM-GS field offices and those recommended by BLM and GS, separately (totalling 723,034.36 acres). Thereafter, on April 1, 1976, the Deputy Assistant Secretary, Program Development and Budget, and the Deputy Assistant Secretary, Land and Water Resources, after considering BLM-GS recommendations on tentative tract selections determined that the number of tracts selected should be increased to 229 blocks totalling 1.3 million acres. Officials of the affected coastal States were personally contacted by the New Orleans OCS Office and informed about the additional tracts subject to tentative selection. The State officials were asked to submit their views and recommendations regarding tentative selection of these additional tracts to Mr. Al Powers, Director, Office of OCS Program Coordination. These State officials were assured that their comments would be given consideration regarding the amount of the increase in tracts to be tentatively selected. Letters responding to this request were submitted by the Governor of South Carolina (April 16, 1976) and representatives of the States of Florida (April 16, 1976); Georgia (April 16, 1976); and North Carolina (April 21, 1976). Each communication noted that the additional tracts subject to tentative selection had been reviewed and no objections to their selection were interposed. The Governor of South Carolina noted that comments submitted earlier by the State on tracts to be tentatively selected would also be applicable to these additional tracts.

On April 22, 1976, Frank A. Edwards, Assistant Director of the Bureau of Land Management sent a telegram to the Governor of each of the affected coastal states advising each that the comments submitted by the representatives of their respective States relative to a proposed increase in the number of tracts to be tentatively selected had been received and considered. Assistant Director Edwards further advised that the public availability of the approved tentative tract selection list comprised of 225 tracts, totaling 1.3 million acres, would be announced on April 27, 1976 by secretarial news release. Copies of the tract list and advanced news release were sent by mail to each Governor on this same date. On April 27, 1976, the Department announced the tentative selection of 225 tracts totalling 1,280,966 acres for further environmental study in connection with proposed OCS Lease Sale No. 43.

The procedures followed during the selection of tracts for proposed Sale No. 43 are discussed in Section I.B. Further consideration of means to improve coordination between the state and Federal personnel are being developed. Please refer to the letters addressed by the Secretary of the Interior to the Governors of the southeastern states (see Section IX.6.).

Issue No. C-1: The BLM environmental studies program for the South Atlantic was improperly planned and the sampling stations were chosen arbitrarily, thereby resulting in non-representative data.

Raised by: Florida Department of Administration

Response: The benchmark studies have as their scientific objective the attainment of a better understanding of the lithotopes, chemotopes, and biotopes of selected OCS areas where it is anticipated that oil and gas exploration and development will take place. Based on this understanding we will be able to focus on those aspects of the system in which a concentration of effort will yield the most information regarding the problem of impact resulting from low level chronic pollution. Incidentally the benchmark studies provide information that in the interim can be used in conjunction with existing effects data to refine our ability to predict impact. The underlying hypothesis is that there is an impact from the introduction of low levels of pollutants from OCS operations. The first step in testing that hypothesis is to understand the system, that is the function of the interdisciplinary benchmark studies. Information derived from these studies will be available in time to influence critical decisions regarding development plans, operating orders, and effluent guidelines.

These studies were developed from recommendations of the participants in the Atlanta Conference/Workshop and comments received in subsequent coordination meetings held with representatives of state and federal agencies. The recommendations were prioritized according to BLM needs. Overlapping recommendations were coordinated to provide maximum information without duplication of effort. The number and location of transects were determined by overlaying specific recommendations on a map of the oil and gas interest nominations and making the best fit. The need for uniformity of areal coverage, simplified sampling and data interpretation, representative sampling, control stations and lease area interest were all taken into consideration in locating the proposed stations provided in the benchmark RFP (AA550-RP6-20).

The two nearshore stations on each transect were placed to sample the turbid-clearwater zone. The most seaward stations were to sample the shelf edge and slope. The mid-shelf stations were located to sample both sandy and "live" bottoms using the best information available. The above criteria were listed in the benchmark RFP. All Offeror's bidding on this procurement accepted the BLM proposed sampling plan as presented. Each Offeror then proposed slightly different approaches as to the types of samples to be obtained from the proposed stations. The successful Offeror (Texas Instruments) was chosen after technical evaluation by a number of highly qualified scientists from federal agencies including BLM. The Benchmark Contractor has assembled an impressive group of eminent scientists mainly from the

S.E. United States to execute the program. BLM is emphasizing strong management in the environmental studies program to correct earlier weaknesses and ensure timely delivery of quality data products.

Coordination is being effected between all of the contractors in the South Atlantic OCS program and between programs in adjacent OCS regions. The inclusion of quality assurance programs for sample analyses, taxonomy and data are common to all BLM studies programs. Interlaboratory and interprogram calibrations and standardizations of methods are included where appropriate and practical. The studies have been designed to stress the interdisciplinary approach to data collection, as well as data analysis and interpretation. Additional surveys to characterize the Georgia Embayment shelf bottom including side-scan sonar are being planned for the geological program to assist in determining prime locations for site specific studies.

This is a large area with a complex circulation pattern and varying inputs. More intense sampling and surveys are desirable, even though the present program has been deemed adequate to meet BLM needs. However, both BLM funding resources and the ability to respond by the scientific community are being taxed with the present program.

Issue No. C-2: Several reviewers recommended BLM should acquire a data base that will permit the development of predictive models or cultural resource sensitivity zones. Such an information source should define the most likely areas in the South Atlantic OCS where historic shipwrecks and drowned prehistoric archaeological sites might be located.

Raised by: South Carolina Department of Archives and History State of Georgia University of North Carolina - Dirk Frankenburg

Response: This office in cooperation with the National Park Service is proposing that a comprehensive cultural resources evaluation of the South Atlantic be funded so that a single reliable basis can be determined and utilized for assessing potential impacts from offshore petroleum development. Until an acceptable basis for projecting occurrence of cultural resource material on the South Atlantic OCS has been determined all tracts will be considered by the BLM OCS Office Manager as subject to survey.

Issue No. C-3: The Council states that the BLM environmental studies program is deficient with respect to biology, and failed to include most of the Atlanta Conference/Workshop recommendations into the study.

Raised by: State of Georgia Natural Resources Defense Council, Inc., New York, N.Y. State of South Carolina

Response: The conclusions of the Natural Resource Defense Council concerning biological facets of the BLM South Atlantic Environmental Study indicate a misunderstanding of the program objectives.

The objectives are intended to be accomplished by a multi-year, multi-contract program of coordinated studies, not by the first year benchmark program exclusively. The South Atlantic Study Plan (pp. 38-42) clearly identifies eight biological objectives for benchmark data acquisition and six for descriptive data. All of these objectives are being met through studies initiated in the first year. The following is a list of the objectives with the RFP and MOU numbers corresponding to the detailed requirements of each objective indicated in parentheses:

I. Benchmark

A. Infaunal Communities - A quantitative characterization of the benthic infaunal communities representative of the study area (AA550-RP6-20).

B. Histopathology - To establish a data base on the existing health of epifaunal organisms (AA550-RP6-20).

II. Descriptive

A. Benthic epifaunal assemblages of the soft bottom will be described by the analysis of seasonal trawl and dredge samples (AA550-RP6-20).

B. To provide a descriptive reconnaissance of the live reef and other ecologically significant biota associated with hard substrate in the study area (AA550-RP6-20 and AA550-MU6-56).

C. To supplement the existing data base on lower trophic level pelagic biota; to provide supportive data (zooplankton) to the descriptive chemical program (AA550-RP6-20).

D. To enchance the data base on marine mammals and turtles off the Southeastern Atlantic Coast (AA550-RP7-11).

E. To survey literature on regional coastal and marine bird populations to include species identification, enumeration, and life habits (AA550-RP7-11).

F. To establish a pre-development microbiological data base for the study area (AA550-RP7-11 and AA550-RP6-20). The Study Plan explains further that field studies initiated in the first year are intended to be continued for two to three additional years to fully accomplish stated program objectives. The NRDC states that most of the biological recommendations of the BLM sponsored Atlanta Conference/Workshop have not been incorporated into either the BLM Study Plan or the RFP. BLM's analysis indicates that the majority of the recommendations are contained in both the Study Plan and the RFP's prepared for first-year studies. It is the Bureau's contention, however, that the exact numbers of recommendations incorporated in BLM Study Plans should not be considered an important issue. The important consideration is the approach used in establishing priorities for identified data needs. This approach, well described in the South Atlantic Study Plan, necessarily considered the applicability of recommended studies to BLM's decision making needs, as well as scientific, funding, and scheduling feasibility.

Issue No. C-4: There is a need for special environmental studies regarding "live" bottom areas.

Raised by: State of Georgia State of South Carolina

Response: Several comments on the need for special studies to determine the "location, extent, and associated biota" of live bottom areas, and to ensure that "OCS operations will not unnecessarily disrupt these biologically sensitive areas" have been made. The BLM shares this concern for live bottom areas, and has taken steps to determine their location, their associated biota, and to determine an optimal survey method for determining their extent. One of the initial primary concerns of the Environmental Assessment Division, New Orleans OCS Office, in anticipation of the preparation of the draft and final environmental impact statements for OCS proposed sale No. 43 was to determine as much as

possible the locations of known or reported live bottom areas. To this end, a thorough review of the literature and extensive communications with various state and federal officials, regional scientists, and informed laypersons (e.g., fishermen) provided a fairly complete assessment of the locations, types, and extents of the known or reported live bottom areas. To provide ground truth data concerning the locations and associated biota of selected live bottom areas, several of the benthic sampling stations for the South Atlantic OCS Bench Study were selected to coincide with reported live bottom areas. This sampling site selection was made by the studies Contractor, in consultation with the BLM, USGS, and highly esteemed regional scientists participating in the benchmark study. Additionally, the New Orleans OCS Office has initiated a procurement for a special study that is intended to thoroughly survey selected live bottom areas in the general lease sale area, and to also provide an assessment of the efficacy of various survey techniques, as applied to the survey and identification of live bottom areas. This special study will also include biological sampling, to provide additional information on the biota associated with live bottom areas.

These studies will provide the basic information of "location, extent, and associated biota", which when coupled with information provided by fates and effects studies now being planned, will provide the basic data upon which informed management decisions can be made, so as to minimize environmental disruption of these areas. The regional study plan of the existing South Atlantic OCS Benchmark Study (contract AA550-CT7-2) reveals that samples are collected at fifty stations located along seven transects in the Georgia Embayment, making this the most comprehensive sampling program ever attempted in the area. Furthermore, the primary benchmark parameter studies are (1) benthic biological communities, as sampled with a box corer, and (2) baseline levels of selected trace metals and hydrocarbon compounds in the sediments and in biota sampled with a trawl. Additional studies on benthic biological communities include studies of the microbes, the meiofauna, demersal fishes and motile epifauna (as sampled using a trawl), and of baseline histopathologic manifestations in the epifauna and demersal fishes.

Issue No. C-5: Should predictive models indicate cultural resources may be affected as a result of oil and gas development on the South Atlantic OCS, surveys should be made to:

1) Identify all properties eligible for inclusion in the National Register which are within the area of the project's potential environmental impact.
2) Determine the effect the project may have on any such properties identified.

Raised by: State of Georgia

Response: The cost, time requirement and effectiveness of surveying the entire Atlantic Ocean floor from shore to the lease tracts areas for specific identification of cultural resources prior to the proposed lease sale would be impracticable and unnecessary in light of the nation's present energy program. In order to comply with the spirit of the Federal laws calling for protection of our nation's cultural heritage BLM, after consulting with the National Park Service and the Advisory Council on Historic Preservation, will:

1) Propose to acquire a data base which will define the most sensitive cultural resource zones in the South Atlantic. (All proposed lease tracts are considered sensitive until determined otherwise.)
2) Recommend to the Supervisor, USGS, that he require operators who propose to drill for oil and gas or propose to develop undersea petroleum transmission lines within cultural resource sensitivity zones to:
   a) Perform a remote sensing survey so as to identify indications of potential cultural resources (see stipulation no. 2 and draft notice).
   b) Avoid any bottom disturbance activity in areas where any such indications are identified.
   c) Identify any potential cultural resource which may be affected by proposed petroleum related activities.
   d) Follow the requirements of Sec. 105 of Historic Preservation Act and the procedures of the Advisory Council on Historic Preservation (36 CFR 800) prior to approving any activity which might affect a potential national register site or object.

Issue No. C-6: Scheduling of BLM OCS Environmental Studies Program, Relative to OCS Leasing Schedule

Raised by: Fish and Wildlife Service Environmental Protection Agency State of Georgia State of South Carolina Sierra Club, Joseph LeConte Chapter, Raleigh, N.C.

Response: Each of the above commentors has raised the issue of scheduling of the BLM OCS Environmental Studies Program, and its relation to the tentative scheduling of OCS Lease Sales. The Sierra Club has raised the most general question by asking if the sale in the South Atlantic area should be "delayed until all pertinent environmental studies are finished so that appropriate baselines are known before rather than after the fact of development". The response to this comment is that in fact the studies program has been scheduled so as to accomplish this goal. It is frequently stated in BLM environmental impact statements and studies program study plans that actual petroleum production and development does not occur in a frontier lease area for a minimim of three to five years following the first lease sale, and that it may be as long as ten years before major production occurs if it ever occurs. The baseline studies are scheduled to begin prior to proposed frontier area lease sales, so that at least one year's data collection effort may begin prior to any exploratory drilling activity under the proposed sale. In the case of the South Atlantic OCS Area, the proposed lease sale is tentatively scheduled for January, 1978; the collection of baseline data actually began in January, 1977. If it assumed that only three years will lapse between the occurrence of the first lease sale and the initiation of the evleopment phase, then it is obvious that three to four years of baseline data can be collected prior to extensive development.

The Sierra Club further raises the question, "what action has the Interior Department taken to establish ... an adequate data base"? The actions taken by the BLM are synposised on page I-6 to I-9 of the Draft Environmental Impact Statement, OCS Sale No. 43.

The Sierra Club's last comment concerning this topic is that the BLM should decisively justify the lack of a need to complete studies prior to leasing. Quite simply, the studies are initiated prior to leasing so as to document the baseline environmental conditions in the OCS lease area. If, as a result of the baseline studies and of fates and effects studies now being planned, it is apparent that unacceptable environmental impact could result from petroleum development or production activities, the authority exists to modify environmental con-

trol measures by issuing new or amended Departmental operating regulations or OCS Orders, or by issuing Notices to Lessees and Operators. These supervisory mechanisms are binding on the lessees, and may be written so as to provide assurance of environmental protection. They may be issued at any time before or after specific leases have been issued; therefore, it is not essential to have all studies completed prior to leasing.

The U.S. Environmental Protection Agency has commented that area specific environmental studies should be "comprehensive, timely, and amenable to analysis in subsequent documents such as environmental impact statements". We believe that the BLM OCS Studies Program studies can be so characterized. The key descriptor is "subsequent documents". We have made every effort to assure that studies planned are as comprehensive as possible, within the constrains of time, funding, and applicability to the BLM mission of minimizing environmental degradation that might result because of OCS oil and gas exploration, development, and production activities. The timeliness of the studies has been discussed above. To briefly reiterate, the studies are scheduled so as to gather data and generate information that will be useful to the decision-maker in the OCS minerals resource management program, not only the pre-lease determinations, but also post-lease decisions, and decisions affecting subsequent lease sale proposals. Obviously, the results of present baseline studies will be available for subsequent environmental impact statements.

The EPA also comments on the need for fate and effect studies addressing "pollutant pathways and mechanisms for uptake and utilization in marine ecosystems". The BLM has long recognized the need for such studies, and has initiated the preliminary planning for these types of studies. It is anticipated that an RFP (Request for Proposals) will be released in the future to further define the scope and direction of fate and effect studies to be conducted for the BLM under the Environmental Studies Program.

The South Carolina Governor's Office has commented that the OCS Environmental Studies Program should be integrated more effectively in the preparation of the draft environmental impact statement, and in other leasing decisions contemplated by the Department. We can only reiterate that the Studies Program is not designed solely to support the preparation of draft environmental impact statements, but rather is designed to provide information for decisionmakers. Although the results of the environmental studies conducted are not usually available for the first draft EIS for any given lease area, they are available for subsequent environmental impact statements.

The Georgia Office of Planning and Budget notes that the Environmental Studies Program has been criticized for a failure to incorporate nearshore and onshore ecological impact studies, as well as studies of the fates and effects of spilled oil, and that the study results are not scheduled so as to be available for pre-sale decisionmaking. We have emphasized repeatedly that we feel it would be inappropriate to initiate site-specific nearshore and onshore studies prior to exploration.

It would not be appropriate to study nearshore or onshore areas that would not be impacted by offshore activities, and it is not possible to determine the locations of offshore activities and to speculate on possible nearshore and onshore impact areas, until after exploration has begun. If extensive exploration indicates the probable development of an extensive petroleum find, it will then be possible to effectively develop site-specific studies for the areas to be impacted. To attempt to study all areas that conceivably might be impacted, based on pre-exploration suppositions, would only dilute the study effort possible by spreading it over a much wider area. Comments on fates and effects studies and scheduling, per se, have been addressed above. The Georgia Office of Planning and Budget further comments that environmental studies for proposed lease sales no. 54 (Blake Plateau) and no. 56 (South Atlantic) should "begin well before the sale so as to enable the findings to be used in the preparation of pre-sale EIS's, and to serve as viable inputs into early decisions". The environmental studies conducted in any given potential leasing area are not tied to a specific lease sale proposal; rather, they are developed to provide appropriate data for decision-makers. Data gathered under the existing environmental studies program will be available for preparation of subsequent environmental impact statements, and as inputs into later pre-sale determinations. Furthermore, contracts have already been let to gather and synthesize data for the nearshore and offshore Georgia Embayment, and for the Blake Plateau. As the results of the Blake Plateau information gathering and synthesis effort becomes available, it will be possible to plan appropriate studies for the area. Any studies conducted in that area will necessarily be radically different from the more neritic studies now conducted in the Georgia Embayment. The Georgia Department of Natural Resources has commented on a need to incorporate information gathered under provisions of lease stipulations into baseline studies.

The results of such stipulated studies will be available to decision-makers, whether or not these data are physically incorporated into baseline study reports. Additionally, the DNR comments on a need by the states to receive in a timely manner information about the baseline data being gathered, and to comment about additional data needs. The South Carolina Governor's Office has suggested that state officials, especially OCS Environmental Studies Advisory Committee members, be invited to attend the studies contractor's presentations to the BLM.

The OCS Environmental Studies Advisory Committee representative from each state is invited to each baseline study quarterly meeting. Since these individuals are appointed by the governor of each state, they are in a position to convey to their appropriate state government officials information about the studies program on a quarterly basis. Representatives from each state have a forum for stating additional data needs not only at these quarterly meetings, but also at the Washington meetings of the OCS Environmental Studies regional and Advisory Committee.

The Fish and Wildlife Service has questioned whether or not "baseline biological studies to determine benthic distributions will be made under contract to BLM before any drilling activity takes place", and if so, how the baseline data will be used to protect benthic organisms. The existing benchmark studies, initiated well prior to any exploratory drilling, will broadly determine the distribution of benthic infauna and epifauna, meiofauna, and demersal fishes.

Additional special studies now planned will further delimit the distribution of selected "live bottom" areas. If it is determined, based on these studies, that sensitive benthic areas are proximate to leased areas, it is possible to require mitigative actions to protect the biota through the previously mentioned supervisory mechanisms. If it is determined that sensitive areas are

not proximate to leased areas, or that remote sensing areas will probably not be impacted, no mitigative measures would be necessary.

Issue No. C-7: A major concern was that studies on the effect of oil (esp. chronic) and trace metals on marine organisms were not included.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: It is essential that we begin to understand the impact of the introduction of low level amounts of petroleum hydrocarbons into the marine environment. It is assumed, in the absence of extensive proof, that such a thing happens on a continuous basis as the result of offshore oil and gas development activity. It has been postulated that such low level contamination is a greater source of danger to marine life than the less frequent, but more dramatic, catastrophic spills such as the one that took place in the Santa Barbara Channel in 1969. In order to solve the problem of predicting the impact (as stated above), there are several pieces of information that must be in hand:

1. The nature and extent of the resource(s) that could potentially be impacted;
2. The effects to be anticipated and their nature of frequency;
3. The factors in the environment that might reflect the presence of contaminants before their biological effects are seen;
4. The rate of introduction of contaminants from platforms and changes that they undergo in the environment.

The key to the whole problem is understanding what in the ecosystem might be effected, and what of all those potentially impacted components of the ecosystem are the most sensitive and/or most important (either economically or ecologically). It is recognized that any continental shelf ecosystem is a complex, dynamic system composed of many components and exhibiting many processes. To attempt to study the fates and effects in a specific area or to conduct process studies, as has been suggested, would be an effort with a low probability of success for benefiting the OCS minerals management program. We understand imperfectly, at the present time, the general character of the system with which we are trying to deal. Many basic questions must be answered in greater detail than existing information generally provides:

1. What are the quantitative and qualitative aspects of biological communities in the shelf ecosystem? How are organisms distributed? Which are the most important? What are the most sensitive?
2. How do the distributions of organisms relate to the distribution of petroleum hydrocarbons, trace metals, and geological parameters?
3. What is the "general health" of the community?
4. What are the ambient levels of potential contaminants from rigs?

Within the limits imposed by human, material, and monetary resources a better understanding of the system with regard to the above stated questions must first be established and then a focus on the key aspects of that system where concentration of effort will get at the answers to 2, 3, and 4, should be considered. We cannot answer key questions such as "what is the amount of petroleum hydrocarbon(s) that will result in toxicity to x marine organisms", until we know whether it is an absolute amount, or the incremental change above background that is critical.

At this time BLM is developing a plan for a program of studies on fates and effects of petroleum contaminants in the marine environment. The draft document describing BLM's approach to these studies is expected to be distributed to the OCSESAC during the summer (August), 1977 meeting. After the plan is finalized it is anticipated that RFP's will be published, and unsolicited proposals applicable to the BLM "fates and effects" program will be considered for funding in fiscal year 1978. This organized approach for design of these studies is intended to prevent duplication of efforts among region-specific studies and to provide for comparability of techniques and data products.

Issue No. C-8: Studies program must provide adequate information required to make decisions and to build a data base. DES is deficient because it fails to delineate how the information will be used in the decision making process.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: The BLM has stated on a number of occasions that its primary objective for conducting the benchmark, geological, physical oceanographic and special studies, and related information summaries is to address specific problems being faced by the decision makers in the process of managing the OCS mineral resources. Within this blanket objective there are a number of sub-objectives, each related to various aspects of the decision-making process. Some of these include:

1) The determination of the location and nature of geologic hazards that could pose a threat to the safe conduct of oil and gas exploration and development activity. It is important that the data generated from surveys looking for potential geologic hazards is interpreted by competent scientists within the framework of proven scientific objectives, and further that these data be incorporated into the development plan approval process. When such studies have been made they are used at any stage of the decision-making process.
2) The identification and characterization of biologically sensitive regions is included in the studies program to provide the decision-makers adequate information to ensure protection of these regions.
3) The characterization of the regional physical oceanography and meteorology provide a basis for evaluating the risk to structures and to the environment in general from the possible release of oil and gas development related containments.

Issue No. C-9: The DEIS is replete with examples of the inability to analyze risks of environmental harm due to lack of knowledge about oil and gas resources available. For example, in I.C.1. it is stated that it is too conjectural to predict at the present time the positioning and landfalls for pipelines. It is stated in I.C.2. that while the scope and nature of development attending this lease sale can be anticipated in part, the scenario of development anticipated could vary "when it becomes more clear what resource potential exists and where it is located".

Furthermore, in III.A.7. it is unabashedly admitted that it is not possible with any degree of certainty to indicate the location of future facilities which may result from the proposed lease sale.

Raised by: Florida Department of Administration

Response: The capability exists to analyze risk of environmental harm in a general sense. Until there has been a suc-

cessful exploration effort establishing a precise location of hydrocarbon resources and a more precise estimate of the amount of resources present, it is not possible to analyze any risks in a specific manner, e.g. risks attendant on location of future facilities. This type of information will be available for environmental analysis prior to any development activity and for any EIS prepared for such activity. In the event the proposed sale is held and there is successful exploration, Secretary Andrus has stated that a development stage EIS will be prepared for the South Atlantic OCS area (See letter to Governor of Florida, Section IX.6.). Section IV of the impact statement discusses additional responsibilities in OCS energy and environmental matters. Many of the procedures and regulations are directed toward site specific activities, when and if, they are undertaken.

Issue No. C-10: Inadequate data is available concerning qualitative and quantitative aspects of pelagic bird distributions and life history.

Raised by: Fish and Wildlife Service

Response: The RFP for a "Summary and Analysis of Environmental Information on the Continental Shelf and Blake Plateau from Cape Hatteras to Cape Canaveral" was released on January 31, 1977. Some of the "information" that the OCSESAC Subcommittee felt could be supplied by Special Studies will be made available pursuant to a study responsive to this RFP. In fact, the necessity for updating the historical data base in the first year of studies, including information on marine mammal and turtle, and bird distributions was addressed in the "Marine Environmental Study Plan for the South Atlantic Outer Continental Shelf Area - Georgia Embayment and Blake Plateau Regions".

Issue No. C-11: A diagram of the Summary of Activities Expected to Result from the Proposed Sale would be most helpful. A chronological chart depicting the inter-actions, overlaps and, most importantly, onshore service support functions for each segment would improve the understanding for the reader.

Raised by: State of South Carolina

Response: Tables incorporating the assumptions made for developing the scenarios of possible development have been included on the table included in Section I.C. Schedules of drilling activity and the operation of bases have been included in Appendices B and K.

Issue No. C-12: The State of South Carolina expresses its opinion on pipeline versus tanker crude oil transport.

Raised by: State of South Carolina

Response: The wide display in various researchers' findings on this subject is evidence of the complexity of this problem. FES proposed stipulation No. 5 (IV.D.) would require the use of pipelines over tankers when and if environmentally, technically, and economically sound. Table III.A.-E.2 summarizes differences between these two transportation methods. Section III.A.4. discusses probabilities of oil spill in the South Atlantic for a variety of reasons.

Issue No. C-13: On page I-7, section C.3. care must be taken in Benchmark Studies to avoid situations from developing as those with the SUSIO group during the MAFLA Studies. Data gaps in information particularly in Benchmark Studies must not occur. Discontinuity in seasonal samplings may render previously collected environmental data useless for benchmark evaluations.

Raised by: State of South Carolina

Response: This is answered in issue number C-3, Section II.

Issue No. C-14: The data from BLM studies should be available to the states at the earliest possible time. It is recommended that all future contracts require the storage of raw data into the NODC computer as soon as it becomes available.

Raised by: State of South Carolina

Response: BLM is sympathetic to the desire of real-time information transfer, but must face reality. Principal Investigators would be reluctant to have their preliminary or uncorrected raw data disseminated indiscriminantly. This factor tends to reduce PI input through Quarterly Reports when they are distributed and used improperly. Furthermore EDS neither wants nor would accept data it knew to be in a raw unverified condition. Much of the data is dependent upon other information and benefits from the synthesis process of correlating it to seasonal data and related investigations common to the interdisciplinary approach stressed by BLM. Finally, BLM has the responsibility for reviewing all contracted data products prior to release.

BLM is constantly seeking and implementing practices directed to improving the planning, sampling, analysis, synthesis and dissemination steps of the environmental data gathering process. Some of the information modes presently used are: the presentation of study highlights to the OCSESAC, invitations to State representatives to attend program quarterly meetings, and the distribution of final reports to State designated libraries. BLM actively seeks and greatly appreciates constructive criticism and helpful recommendations to improve the program especially with respect to the most effective use of studies results.

Issue No. C-15: The composition of hydrocarbon degrading microbial communities can be expected to vary with the type of crude oil. Since no crude has been recovered from the South Atlantic OCS care must be taken in selecting the crude oil or its fractions to be evaluated in degradation studies.

Raised by: State of South Carolina

Response: Since the character of petroleum products which may exist in the Georgia Embayment is pure speculation at this point, almost any crude could be justified for experiments. The care (or caution) to be taken is in the interpretation and application of the results rather than the particular petroleum used. It could be argued that one should use a crude from a close geographical area or the crude most frequently used in such studies. The choice of South Louisiana crude fits these criteria.

Issue No. C-16: Specific assurance is needed indicating that the environmental studies program impact studies will include the tideland areas of South Carolina.

Raised by: State of South Carolina

Response: See response in Section I, issue No. C-6.

Issue No. C-17: Major recommendations which are not included in the environmental study program are "all studies of biological process dynamics, i.e., studies of microbial heterotrophic potential, nitrogen fixation, and sulfur metabolism; studies of trophic bio-accumulation of potential oil and gas pollutants; and community metabolism and energy fluid . . ."

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: The above is a major undertaking involving several years of concerted effort and has begun with microbial studies in the present South Atlantic Benchmark program. Other studies on fates and effects are being developed.

Issue No. C-18: The Environmental Studies Program failed to incorporate nearshore and onshore ecological impact studies.

Raised by: State of Georgia

Response: It has been BLM's approach to initiate nearshore environmental studies prior to leasing only in areas where leasing, exploration, and development are to take place within twenty miles of the shoreline, or where some unique conditions exist that might contribute to coastal pollution. The tracts proposed for leasing action in the South Atlantic OCS region range from approximately 30 to 75 miles from shore. Any exploration impacts will likely be localized to the offshore area with no impact in the nearshore or coastal zone. Impacts in the coastal zone are expected to be more likely after development has commenced. The sequence of events from lease sale to actual production of oil or gas resources spans a minimum of three years, and often five or more years. For these reasons, BLM has considered the anticipated time of impact in establishing a schedule for information gathering and a priority for expenditure of funds. In regions such as the South Atlantic OCS, this approach results in studies being initiated prior to leasing in the offshore areas where environmental impacts might be anticipated. Also, see responses to Issues D-2 (Section I) and A-5 and A-6 (Section IV).

Legislation now pending before Congress (S-9) contains provisions which, if enacted, would require studies in those nearshore areas which could be affected by OCS oil and gas activities.

Issue No. C-19: The Environmental Studies program now underway in the Bureau of Land Management has been extensively criticized by the scientific community. Not only has the program failed to incorporate nearshore and onshore ecological impact studies and fates and effects of spilled oil, it also has been scheduled so that findings are not available for pre-sale decision-making. We suggest that the program be restructured to include an adequate balance of studies of baseline conditions and fates and effects in offshore and onshore areas, and then rescheduled to provide data in a timely manner for use in pre-lease decision-making.

Raised by: State of Georgia

Response: See Response, Section I, Issue No. C-6.

Issue No. D-1: The State would like the opportunity to review the PDOD prior to its submission to the Secretary so that we may be aware of its content and orientation. We consider the OCS development program extremely important to the people of Georgia and wish to ensure that our interests and concerns are communicated to the Secretary in the most effective manner.

Raised by: State of Georgia

Response: It is the Department's position that the PDOD for a proposed OCS oil and gas lease sale is an intragency document involving the advice and recommendations of Departmental staff and policy level officials on the economic, technical and environmental aspects of the proposed lease sale. The PDOD is subject to continuing review and revision up to the time it is presented, with a request for a decision, to the Secretary. The discussion contained in the PDOD relative to the environmental aspects of the proposed sale represents a summary of the environmental impacts of and attachments to the proposed action as discussed in the final EIS. Thus, in this regard, it is a summary of environmental information already made available to Federal, State, and local agencies, and interested members of the public. In view of the above the Department feels that it is unwise to disseminate the PDOD in draft form prior to the Secretary's decision whether or not to authorize the proposed lease sale. However, the Department will make available to the State of Georgia and any other interested party a copy of the final PDOD presented to and acted upon by the Secretary.

Issue No. D-2: Separation of exploration from development and production, either through government sponsored exploration or separate leasing for exploration should be required.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: The subject of separation of exploration from development and production is discussed in Section VIII.D.2. in the final EIS for the Accelerated OCS oil and gas leasing program. The Department has, as discussed in Section VIII.D.3. of the final EIS for Proposed OCS Lease Sale No. 43, provided for a more extended review of the lessee's potential development operations, including provision of information to and participation by affected coastal States (See 30 CFR 250.34). See letter of July 22, 1977 to Governor Busbee of Georgia (Section IX.6.).

The subject of government financed exploration is discussed in Section VIII.D.2. of the final EIS for proposed OCS lease sale No. 43. In the event the proposed lease sale is held and there is successful exploration, Secretary Andrus has stated that a development stage EIS will be prepared for the South Atlantic OCS Area. In addition, legislation now pending before Congress (S-9), which this Administration supports, contains provisions for the government to contract for exploratory drilling should national security or special environmental reasons require it or to facilitate efficient exploration and development of resources.

Issue No. D-3: An environmental impact statement should be prepared after exploration and before development and production is permitted, to allow maximum preparation and planning by shore communities and states for impacts and facilities resulting from the OCS lease sale.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: Existing responsibilities for operations that may occur after some exploratory work has been accomplished have been described in the text of the draft impact statement. Appendix H discusses changes in 30 CFR 250.34 proposed in order to set forth procedures for state consideration of OCS developments. Refer to letters addressed to the Governors of the southeastern states by the Secretary of the Interior (see Section IX.6.). An impact statement will be prepared following the exploration phase. This statement will incorporate additional data resulting from the exploratory drilling.

Issue No. D-4: The Department of Interior seems to have accepted as a foregone conclusion that the proposed lease sales should and will occur regardless of the resulting adverse environmental impacts. By assuming this attitude the Department has proposed OCS Sale No. 43 before being in an adequate position to assess the environmental impacts which might occur from such sale.

Raised by: Florida Department of Administration

Response: The approved accelerated leasing program that includes proposed sales in the South Atlantic does not constitute a decision on this proposed lease sale. This site-specific proposal is being considered in a final site-specific EIS. A decision whether or not to hold this sale

will be made only after the Secretary has considered the environmental, technical, and economic aspects of this particular lease sale proposal, and no sooner than 30 days after the final EIS has been submitted to CEQ and made available to the public. The proposed sale schedule and the specific selection of tracts to be included within each proposed sale are continuously under review.

Issue No. D-5: The State of South Carolina is most interested in the updating of the Proposed OCS Planning Schedule should such an occasion arise. This will allow the State the opportunity to judiciously allocate our resources to ensure proper and environmentally safe development of the South Atlantic OCS hydrocarbon resources, and related onshore development.

Raised by: State of South Carolina

Response: On May 17, 1977, the Secretary, having requested the input of all affected States, announced a revised OCS Planning Schedule, for OCS oil and gas lease sales proposed through 1978 (see Section I.D.). The Department has requested comments regarding the development of the OCS Planning Schedule for proposed sales through 1981. The input of the States adjacent to proposed leasing areas is essential to the development of a reasonable planning schedule.

Issue No. E-1: There should be an agreement drawn up between the Departments of Commerce and Interior coordinating states' review of OCS development plans.

Raised by: Florida Department of Natural Resources

Response: Section IV.A.1.b. summarizes briefly the proposed OCS Operating Order No. 15 which requires that oil and gas lessees submit their Development Plans directly to affected states for their review and comment (See also Appendix G).

The Department of Commerce functions regarding OCS development plans will become effective upon approval of a CZM plan of an affective coastal State. It is estimated that all states in the South Atlantic will have approved Coastal Zone Management Plans by the spring of 1979. By that time, the consistency provision (Section 307 of CZMA) will be fully operative. The requirements state basically that OCS lessees, when submitting a plan of exploration, development, or production to the Department of the Interior, must also submit it to the affected state(s). A certification of consistency of this activity with a state plan and its affect on land and water use in the coastal zone will be required when an approved state plan is in effect. All information desired by the state to backup the certification of consistency will also be included. At the time of this meeting, final regulations for implementation of the consistency provision have not been issued by the Department of Commerce.

Issue No. E-2: OCS activity should be delayed until Coastal Zone Management plans are completed.

Raised by: The Sierra Club Florida Audubon Society

Response: One alternative to the proposed action is to delay the proposed sale until state CZM plans are approved. This alternative is examined in Section VIII.B. of the FES for proposed OCS Sale No. 43.

Issue No. E-3: Will the sale conflict with other ocean use? If so, to what extent? Could ocean zoning areas, much as land areas now are zoned, be established?

Raised by: Sierra Club, Joseph LeConte Chapter, Raleigh, N.C.

Response: The proposed sale and consequent resulting development on the OCS would result in a potential conflict with other ocean uses, mainly those of navigation, fishing, and in some areas of use by the Department of Defense. These potential conflicts will be considered by the Secretary prior to any decision as to this lease sale proposal. Various governmental agencies which have supervisory functions and their protective responsibilities, are set forth in Section I.E. of the FEIS. Certain aspects of a decision to lease specific tracts involve a process bearing similarities to land zoning. Other uses of the ocean and their effect on the environment are carefully considered. An example of this process is the establishment by the Coast Guard and Corps of Engineers of fairways and safety lanes where obstructions to navigation are prohibited. Also, in some ocean areas the Department of Defense has established zones where leasing is prohibited.

Issue No. E-4: How will the states be integrated into all phases of OCS planning and development?

Raised by: The Sierra Club, Joseph LeConte Chapter, Raleigh, N.C. State of South Carolina

Response: States have input into OCS activity through several different mechanisms: tract nomination briefings, the OCS Environmental Studies Advisory Committee, tentative tract selection process, the environmental statement review procedure, coastal zone management planning, recommended lease stipulation No. 4, proposed OCS Operating Order No. 15, and state permitting requirements for onshore facilities within their jurisdiction.

Issue No. E-5: The existing local and state regulatory authorities directly affecting OCS operations were not fully addressed in I.E.2. or in the Impact Section III.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y. Florida Department of Administration

Response: Additional information regarding state and local regulatory authorities has been included in Section I.E.2. of the FES.

Issue No. E-6: Without knowledge of what amount and at what location oil and gas is present on the Outer Continental Shelf, it is impossible to adequately analyze the environmental and economic impact of producing and transporting that oil and gas. Without a knowledge of the amount and location of the oil and gas, it is not possible to state what will be involved in its production or transportation. It is likewise impossible to engage in more than mere conjecture as to what the adverse environmental consequences of the OCS Sale No. 43 might be. It is further not possible to make any analysis of the steps which could be taken in mitigation of the adverse environmental impact.

Raised by: Florida Department of Administration

Response: The capability exists to analyze risk of environmental harm in a general sense. Until there has been a successful exploration effort establishing a precise location of hydrocarbon resources and a more precise estimate of the amount of resources present, it is not possible to analyze any risks in a specific manner, e.g. risks attendant on location of future facilities. This type of information will be available for environmental analysis prior to any development activity and for any EIS prepared for such activity. In the event the proposed sale is held and there is successful exploration, Secretary Andrus has stated that a development stage EIS will be prepared for the South Atlantic OCS area (See letter to Governor of Florida, Section IX.6.). Section IV of the

impact statement discusses additional responsibilities in OCS energy and environmental matters. Many of the procedures and regulations are directed toward site specific activities, when and if, they are undertaken.

Issue No. E-7: The recent decision of Judge Weinstein in County of Suffolk v. Secretary of the Interior, Case No. 75-C-208, U.S.D.C. for the Eastern District of New York, the adequacy of the Final Environmental Impact Statement for the Mid-Atlantic OCS Lease Sale No. 40 was reviewed. In his opinion, Judge Weinstein stated that the environmental impact statement must be site specific, that is, must consider the specific conditions in the sale and the actual environmental effects of exploration and development resulting from the sale, as well as the reasonable alternatives. In the context of the proposed South Atlantic OCS Sale No. 43, it is clear that such an analysis can only be done after more is known about the amount and location of the resources to be developed.

The DEIS further fails to fully discuss, evaluate and consider the impact of state and local regulatory powers on the transportation of the oil discovered. The DEIS assumes that there will be two pipelines transporting the oil to onshore facilities. The Department fails to predict the routes of these pipelines or their alternatives or the effect of local and state regulations on those routes.

Certainly, local and state regulations will, to a large extent, determine what environment will be affected by the transportation of the oil and gas to shore. While recitation is made in I.E.2. of the existence of local and state regulatory powers, such recitation is not enough to satisfy NEPA, which requires evaluation and consideration, and an estimate of the effects. The impact of these factors, and not just their existence, must be considered. The fact that there may be coastal zone management programs in the future is no excuse for the omission of this analysis from the DEIS. The Environmental Impact Statement for the Mid-Atlantic Lease Sale has been found to be legally deficient for failure to include an adequate analysis of the effect of local regulations. County of Suffolk v. Secretary of the Interior, supra. The DEIS for the South Atlantic appears to suffer from the same legal deficiency.

Raised by: Florida Department of Administration

Response: The Secretary's appeal of Judge Weinstein's order is pending before the U.S. Court of Appeals for the 2nd Circuit. The text of the statement has been revised. Hypothetical pipeline routes have been delineated as a means of analyzing in a more site-specific way, the kinds of impacts that may result from such an operation. However, at this time there is not sufficient information regarding locations and amounts of oil and gas to predict that these routes will be used. Additionally, the affected States will have to play a major role in defining eventual pipeline landfalls (see Section I.E.).

In the event the proposed sale is held and there is successful exploration, Secretary Andrus has stated that a development stage EIS will be prepared for the South Atlantic OCS area. Precise information about the location and potential amount of resources will be available at that time for evaluation in the development stage EIS.

Issue No. E-8: The statement that the Coast Guard performs surveillance for oil spills and discharges along pipelines from offshore facilities to the shore is misleading since it infers that the Coast Guard conducts dedicated surveillance patrols to detect pipeline leaks. The Coast Guard conducts pollution surveillance patrols to detect oil discharges within territorial and contiguous waters. Occasional patrols are made within the prohibited zone, normally within 50 miles of land, to enforce the International Convention for the Prevention of Pollution of the Sea by Oil, 1954, as amended. The Coast Guard has no authority to conduct pollution surveillance of oil rigs and pipelines on the OCS.

Raised by: Department of Transportation, Coast Guard

Response: The statement on page I-13 of the DEIS with which the Coast Guard takes issue is a broad statement to the effect that the Coast Guard and USGS look for oil spills and discharges along pipeline routes offshore. The statement has been revised in the final EIS to more precisely delineate the Coast Guard activities in this regard.

Issue No. E-9: The terminology in the description of the intent of the Coastal Zone Management Act should be consistent with the wording of that Act.

Raised by: Department of Transportation

Response: The FES has been revised to reflect more closely the wording of the CZM Act of 1972 as amended.

Issue No. E-10: "All pipelines should be designed, constructed, operated, and maintained in accordance with 49 CFR Part 192 for natural gas pipelines and 49 CFR Part 195 for liquid pipelines."

Raised by: Department of Transportation

Response: We agree with this statement and have placed it in proper context by adding—"and in accordance with applicable BLM and USGS requirements, rules and regulations, are subject to the MOU of May, 1976 between DOT and DOI."

Issue No. E-11: The discussion of the Coastal Energy Impact Program in the DES was inadequate considering the importance of this program for ameliorating potential impacts of onshore activities.

Raised by: State of South Carolina

Response: The discussion of this program has been expanded in the FES (Section I.E.).

Issue No. E-12: Hazardous areas as identified by the National Flood Insurance Program have not been outlined in the DES.

Raised by: State of South Carolina

Response: We believe that areas where potential OCS operations would be hazardous have been adequately described in the Final EIS without reference to the National Flood Insurance Program. Any onshore development resulting from proposed Sale 43 will be subjected to local zoning authority.

Issue No. E-13: The statement that all development below mean high water in South Carolina is federally controlled is inaccurate.

Raised by: State of South Carolina

Response: This statement has been corrected in the FES (Section I.E.).

Issue No. E-14: South Carolina and the coastal states affected by offshore oil and gas operations need Congressional legislation passed to ensure a fair and equitable distribution to the states of the royalties received by the Federal Government from production beneath the Outer Continental Shelf (OCS) areas of the United States.

Raised by: State of South Carolina

Response: Legislation to amend the Outer Continental Shelf Lands Act Amendments of 1953, which is under consideration in the Congress at the present time, would

not provide for sharing of royalties. It does however provide for assistance to coastal states in ameliorating or reducing adverse impacts resulting from the exploration for, or the development or production of, energy resources, particularly those sources identified with the Outer Continental Shelf. Grants would be based on the volume of oil or natural gas produced on the OCS adjacent to the coastal state, or landed in the coastal state. The amounts of the grants range from 20 cents per barrel during the first year, with reduction of 8 cents per barrel during the fourth to tenth years. Further discussion of these amendments is contained in Calendar No. 262. Report No. 95-284, 95th Congress, 1st Session (Senate) Outer Continental Shelf Lands Act Amendments of 1977. Report of the Committee on Energy and Natural Resources, United States Senate (S-9), obtainable from the U.S. Government Printing Office, Washington, D.C.

Issues Concerning Description of the Environment

Issue No. A-1: How can the availability of data from exploration wells be obtained?

Raised by: State of Georgia

Response: Well cutting samples and electric logs must be requested from: U.S. Geological Survey Mr. George Brown Conservation Manager Eastern Region 1725 K Street, N.W., Suite 204 Washington, D.C. 20026

Issue No. A-2: Where can bathymetric and hazard data be obtained by the State of Georgia?

Raised by: State of Georgia

Response: For the availability of bathymetric data, hazard surveys and live bottoms contact Mr. George Brown, USGS, Conservation Manager, Eastern Region, 1725 K St. N.W., Suite 204, Washington, D.C.

Issue No. A-3: Further discussion concerning alternative technology for development of OCS oil and gas resources should be included in the FES to: a) prevent major oil spills from pipelines due to earthquakes; b) platform collapse; c) pipeline burial in hard bottom areas.

Raised by: Environmental Protection Agency

Response: a) OCS Order No. 9 for the Gulf of Mexico outlines the design requirements for pipelines: "all oil and gas pipelines leaving a platform shall be equipped with a high-low pressure sensor to directly or indirectly shut in the wells on the platform. Alternative technology would not be utilizing the latest and most sophisticated technology.

b) As stated in Section E. Other Mitigating Measures, No. 4. "High resolution geophysical data covering all tracts to be offered for this proposed sale are presently being analyzed by geophysicists of the USGS. Karst topography may be detected by the high resolution geophysics collected. Any alternative procedures would not accomplish the desired detail needed.

c) The following paragraph has been added to Appendix C, Oil and Gas Operations. Difficulties in trenching in hard bottom areas may be resolved by utilizing a remote controlled trenching machine which is capable of burying pipelines beneath the seabed at water depths to 1,640 feet. The machine attaches to a mother ship by control cable which directs the excavators eight propeller-thrusters for special ballast tanks, clamps and digging head. It descends to the ocean bottom, "homing in" with radar and television on the prelaid pipeline to be buried.

Issue No. A-4: The geologic and bathymetric mapping for South Atlantic OCS is inadequate.

Raised by: Ivan Teper, Atlanta, Ga.

Response: On page seven of Mr. Teper's comment "other areas in which information is inadequate" the impact statement recognizes the need for additional geologic mapping offshore. New information is being collected by the USGS and will add substantially to what is now known. With regard to bathymetric mapping; the New Orleans OCS Office has a comprehensive program, the entire U.S. South Atlantic coast will be mapped at a scale of 1:250,000 by the end of 1978.

Issue No. A-5: Subsidence in the Savannah, Georgia area should be discussed.

Raised by: Geological Survey

Response: The article which has been referred to us on subsidence in the Savannah, Georgia area has been incorporated in section II.6.e. and a separate evaluation of the effects on water supply has been added to Section III.D.9.

Issue No. A-6: The legend and key to Figure A-2 is questioned for clarity.

Raised by: State of South Carolina

Response: The legend and key for Figure A-2, Section I have been clarified.

Issue No. A-7: Concern for the protection of live bottom areas was expressed.

Raised by: State of South Carolina

Response: Special stipulations listed in Section IV.D., if adopted will require that a survey be made which would delineate any "live" or "hard" bottom areas for the purpose of protecting any resources which may be present.

Issue No. A-8: The information presented suggests that more study is necessary to delineate and evaluate the live bottom areas in the South Atlantic OCS region.

Raised by: State of South Carolina

Response: A "Request for Proposals" (RFP) for a special study of the live bottom areas in the South Atlantic OCS will be released in the fall of 1977. Live bottom mapping is currently underway by the USGS-Marine Geology Division under a memorandum of understanding with BLM.

Issue No. A-9: The dots on Figure A-10, page II-13 should be removed to allow for easy readability.

Raised by: State of South Carolina

Response: Figure A-10 has sample location dots referred to in the Marine Surficial Sediment Section. For a discussion of bottom draft please refer to B.3.c., Surface and Bottom Circulation—Physical Oceanography.

Issue No. A-10: The USDA soils map should be used with caution.

Raised by: State of South Carolina

Response: The following paragraph has been added to the soils Section. "Relatively shallow soil samples may have been utilized in the development of the soil visuals. Caution in using these visuals should be exercised in the determination of their suitability for construction of large structures.

Issue No. A-11: More information on the erosive potential of soils would be helpful.

Raised by: State of South Carolina

Response: The erosive potential of soils was not discussed in the EIS because no specific onshore construction sites have been selected at this time.

Issue No. A-12: The potential hydrologic problems that could effect the economic and environmental condition of South Carolina should be discussed.

Raised by: State of South Carolina

Response: The following paragraph has been added to Section 5. Coastal and Onshore Geology—C—Hydrology: "The USGS and South Carolina Water Resources Division are jointly conducting a groundwater study in all coastal counties of South Carolina. Monitoring of wells will enable them to map ground water movement, alterations of ground water character, Piezonictric head and the movement of the fresh-salt water interface.

Issue No. B-1: The data available to predict the trajectory of an oil spill seems inadequate and conflicting.

Raised by: State of Georgia

Response: It appears that the process of predicting oil spill probabilities and uncertainties has been overlooked. The purpose of modeling the factors that control the movement of oil spills is to enable a reasonable estimate of the areas that might be affected by an oil spill in this lease area. Such estimates will always contain some degree of uncertainty. The oil spill model used the best available data. If better data were to become available in the future as a result of studies and a model then prepared from that data, uncertainties would still be observed.

Issue No. B-2: In the Bumpus (1973) from 1960-70, ballasted bottles were used to decrease the influence of wind on drift trajectories. Is this condition representative of the behavior of crude oil on the ocean surface? What factor is most significant in oil movement and trajectory? Further, we suggest that due to the heavy dependence of this text on this study, it be included as an appendix to the EIS and appropriately referenced.

Raised by: Environmental Protection Agency

Response: The section is designed to present a description of surface circulation only. The drift bottles were ballasted to ensure response to current alone. The currents measured in this study have already been affected by wind. The drift bottles are not and were not designed to be representative of oil spill movement. Factors affecting the movement of oil spills are described in Appendix L. We believe that the important information has been condensed and included in this section.

Issue No. B-3: Since the coastal area under consideration has large areas of sandy beaches, data is needed on the seasonal changes in beach profiles. Should an oil spill reach shore, during what time of the year would natural beach construction or buildup processes most likely cause the oil to be buried?

Raised by: Environmental Protection Agency

Response: In general, accretion of beaches along the South Atlantic occurs during summer and erosion occurs during winter. Issue No. B-4: What are the wave energy distributions and wave refraction patterns along the coast?

Raised by: Environmental Protection Agency

Response: We do not believe that this information is necessary for environmental analysis for this proposed sale.

Issue No. B-5: Data described in the DES are based on 1953-1954 Gill Cruises. These data are unrepresentative of oceanographic conditions.

Raised by: Department of Commerce

Response: Physical data, if reliable samples were taken even 20 years ago, would not change a significant amount during that period of time. Additional sources are currently being compiled under a BLM contract to update the 1974 VIMS Baseline Literature Survey. Such information will be incorporated into future EIS efforts in this leasing area.

Issue No. B-6: Page II-44: Change 1.5 m to 0.4 m. Page II-54: Change "draft bottle" to "drift bottle".

Raised by: Department of Commerce

Response: The text has been changed to reflect these comments.

Issue No. B-7: Climatology of storm surges along the coast have been computed. Included in the report is recent information, such as the Argo Merchant oil spill, which should be used.

Raised by: Department of Commerce

Response: We believe that the section on storm surge is adequate for purposes of this impact statement.

Issue No. B-8: Future studies are needed for physical oceanography data.

Raised by: State of South Carolina

Response: Please see response in Section I, issue C-8.

Issue No. B-9: Use of common names is confusing. Scientific nomenclature is essential.

Raised by: State of South Carolina

Response: Scientific nomenclature has been used where it is essential. We have attempted to limit the use of common names to those which are widely-known or "universal."

Issue No. B-10: Charleston has only a limited amount of wharf space available (under present constraints) to support OCS operations without developing conflicts and competition for wharf facilities. Expansion should be planned in the Charleston and possibly the Georgetown areas to handle land-based OCS operations.

Raised by: State of South Carolina

Response: If the proposed sale is held and there is successful exploration, the suggested expansion would be evaluated prior to approval of any development plan that might affect the areas referred to.

Issue No. B-11: The conclusion is made on page III-45 that phytoplankton "production" will not be significantly or adversely impacted by offshore oil and gas operations, yet on page II-94 (7th paragraph) it is stated that productivity studies are limited. It is felt that the limited data do not justify this conclusion.

Raised by: State of South Carolina

Response: Section III.B.2. Impact on zooplankton has been revised to state that oil and gas operations may have a severe but local and short-term affect on zooplankton. Large scale food web impacts are more difficult to evaluate and have not been documented.

Issue No. C-l: In line with the information in the Human Utilization of the Commercial Fishery Resource section on king mackerel, we also note that this species is a sought after sportfish. Recent data indicate that it undergoes wide ranging migration through the lease area.

Raised by: National Marine Fisheries Service National Oceanographic Atmospheric Administration

Response: This fact has been added to the text.

Issue No. C-2: There are deficiencies in the chemical oceanography description. It should be noted that there are these deficiencies and action should be taken to fill the gap.

Raised by: State of South Carolina

Response: There is much data available in this area concerning bays and estuaries; however, there exists a major data gap as far as the continental shelf. The OCS baseline study in this area will provide additional information which will be available prior to any development activities resulting from the proposed sale and will be available for future EIS efforts.

Issue No. C-3: Oxygen concentration as percent of saturation should be expressed.

Raised by: Environmental Protection Agency

Response: This comment has been incorporated into the text.

Issue No. C-4: The BLM environmental studies program for the South Atlantic was improperly planned and the sampling stations were chosen arbitrarily, thereby resulting in nonrepresentative data.

Raised by: State of Florida, Department of Administration; University of North Carolina Environmental Protection Agency

Response: The benchmark studies have as their scientific objective the attainment of a better understanding of the lithotopes, chemotopes, and biotopes of selected OCS areas where it is anticipated that oil and gas exploration and development will take place. Based on this understanding we will be able to focus on those aspects of the system in which a concentration of effort will yield the most information regarding the problem of impact resulting from low-level chronic pollution.

Incidentally the benchmark studies provide information that in the interim can be used in conjunction with existing effects data to refine our ability to predict impact. The underlying hypothesis is that there is an impact from the introduction of low levels of pollutants from OCS operations. The first step in testing that hypothesis is to understand the system, that is the function of the interdisciplinary benchmark studies. Information derived from these studies will be available in time to influence critical decisions regarding development plans, operating orders, and effluent guidelines.

The studies were developed from recommendations of the participants in the Atlanta Conference/Workshop and comments received in subsequent coordination meetings held with representatives of state and federal agencies. The recommendations were prioritized according to BLM needs. Overlapping recommendations were coordinated to provide maximum information without duplication of effort. The number and location of transects were determined by overlapping specific recommendations on a map of the oil and gas interest nominations and making the best fit. The need for uniformity of areal coverage, simplified sampling and data interpretation, representative sampling, control stations and lease area interest were all taken into consideration in locating the proposed stations provided in the benchmark RFP (AA550-RP6-20).

The two nearshore stations on each transect were placed to sample the turbid-clearwater zone. The most seaward stations were to sample the shelf edge and slope. The mid-shelf stations were located to sample both sandy and "live" bottoms, using the best information available. The above criteria were listed in the benchmark RFP. All Offerors bidding on this procurement accepted the BLM proposed sampling plan as presented. Each Offeror then proposed slightly different approaches as to the type of samples to be obtained from the proposed stations. The successful Offeror (Texas Instruments) was chosen after technical evaluation by a number of highly qualified scientists from federal agencies including BLM. The Benchmark Contractor has assembled an impressive group of eminent scientists mainly from the Southeast United States to execute the program. BLM is emphasizing strong management in the environmental studies program to correct earlier weaknesses and ensure timely delivery of quality data products.

Coordination is being effected among all of the contractors in the South Atlantic OCS program and among programs in adjacent OCS regions. The inclusion of quality assurance programs for sample analyses, taxonomy and data are common to all BLM studies programs, and interlaboratory and interprogram calibrations and standardizations of methods are included where appropriate and practical. The studies have been designed to stress the interdisciplinary approach to data collection, as well as data analysis and interpretation. Additional surveys to characterize the Georgia Embayment shelf bottom, including side-scan sonar, are being planned for the geological program to assist in determining prime locations for site specific studies.

This is a large area with a complex circulation pattern and varying inputs. More intense sampling and surveys would be desirable, even though the present program has been deemed adequate to meet BLM needs. We note that both BLM funding resources and the ability to respond by the scientific community are being taxed with the present program.

Issue No. D-1: Page II-77. No explanation is offered for a south-to-north increase of the heavy metal gradient.

Raised by: Environmental Protection Agency

Response: This information has been included in the text.

Issue No. D-2: The effects of natural phenomenon on oil and gas facilities should be presented.

Raised by: Environmental Protection Agency

Response: We believe that this subject has been adequately covered in Section III.A.4.e.

Issue No. D-3: The Climatology Section was developed and referenced, leaving out several important sources.

Raised by: Department of Commerce

Response: Another major data contributor to this section was the 1974 VIMS report. The developers of that study used as source material several of the "omitted" references. Data from the Department of Commerce was also used extensively. The BLM has recently let a contract for a study to update its physical oceanography and meteorology background data.

Issue No. D-4: Correction of the trend of tornado direction, and speed of tornadoes are not as great as previously suspected.

Raised by: Department of Commerce

Response: The statement has been changed in the FES.

Issue No. E-1: The DEIS contains an overly large amount of periferal information that only confuses the effort at impact assessment. For example, page II. 119-120 contains a description of upland vegetation; Visuals 3N and 3S contain detailed maps of upland soil distributions; page

II-137 reviews research from Long Island, Rhode Island, St. Andrews Bay, New Jersey, etc., but none in the lease sale area. Research in the sale areas is limited, but there is little value in including information that is clearly not germane to the proposed action.

Raised by: University of North Carolina, Dirk Frankenburg

Response: Attempts have been made and will continue to be made to reduce the amount of non-essential information included in the EIS's. However, we feel that portrayal of a large amount of information through the use of visuals (as we have done) is possible (and useful) without confusing the reader.

Issue No. E-2: What is the data reference for the statement that cetacean ranges seem to be delineated by Cape Hatteras and/or Cape Canaveral?

Raised by: Endangered Species Productions

Response: Rice, D.W. and Victor Scheffer. 1968. A list of the Marine Mammals of the World. U.S. Fish & Wildlife Service, Spec. Sci. Rept. Fish 579, 16 p.

Issue No. E-3: Bottlenose dolphins are taken for public display, however spotted dolphins are not taken.

Raised by: Endangered Species Productions

Response: These two species, Bottlenose dolphins and spotted dolphins, are not taken for public display from the area that is being considered. The Bottlenose dolphin is captured for public display further south than the proposed area and on the Florida west coast.

Issue No. E-4: The fin whale is on the U.S. endangered species list.

Raised by: Endangered Species Productions

Response: This has been corrected in the text.

Issue No. E-5: Manatees do enter freshwater rivers.

Raised by: Endangered Species Productions

Response: The text has been changed to reflect this comment.

Issue No. E-6: The migration routes of manatees has been misrepresented. The status of the Florida manatee apparently lives throughout the coastal waterways of Florida.

Raised by: Endangered Species Productions Marine Mammal Commission

Response: This section has been changed to reflect the points expressed in the comments.

Issue No. E-7: The Florida manatee is not on the increase and its range has not been extended to South Carolina.

Raised by: U.S. Fish and Wildlife Service Endangered Species Productions Marine Mammal Commission

Response: The Florida manatee is not on the increase, however due to increased sighting efforts more manatee are being observed. Recent data reveals a greater range that was previously known. This range extends to South Carolina.

Issue No. E-8: The relationship of various species to one another, and the variability of year classes, particularly relating to nekton is not fully discussed.

Raised by: Natural Resources Defense Council

Response: Due to constraints of practicality, a thorough discussion of marine ecology cannot be made. Within these limitations we feel that our discussion is adequate.

Issue No. E-9: The Fish and Wildlife Service Laboratory, Gainseville, Florida is performing intensive research on the biology of the endangered manatee.

Raised by: Fish and Wildlife Service

Response: This has been recognized in the final environmenal statement.

Issue No. E-10: The Everglades kite, although discussed in the section on endangered species, should be listed in Section II.

Raised by: U.S. Fish and Wildlife Service

Response: This suggestion has been incorporated into Section II.E.2.b.

Issue No. E-11: Page II-125; Cranes, Lumpkins, Rails and Coots - Lumpkins should be Limpkins.

Raised by: U.S. Fish and Wildlife Service

Response: This correction has been incorporated into Section II.E.2.b.

Issue No. E-12: The introduction to the Endangered Species section should include a brief discussion of the designated critical habitat concept.

Raised by: U.S. Fish and Wildlife Service

Response: A discussion of the designated critical habitat concept has been incorporated into Section II.E.2.c.

Issue No. E-13: The listing of endangered species occurring in the U.S. South Atlantic region is incomplete, and should include the following: Eskimo curlew **Numenius borealis** Ivory-billed woodpecker **Campephilus principalis** Blue whale **Balaenoptera musculus** Finback whale **Balaenoptera physalus**

Raised by: U.S. Fish and Wildlife Service

Response: These additional endangered species have been added to Table E-15, Section II.E.2.c.

Issue No. E-14: River water coming from upland areas in which agriculture is practiced may not be phosphate poor as reported on pages II-90-95, and observed low productivity offshore during certain seasons may be due to other factors.

Raised by: State of South Carolina

Response: We agree that it would seem reasonable that rivers draining agricultural regions would carry high phosphate loads. However, in the passage questioned the DES was reporting the conclusions of one researcher.

Issue No. E-15: On Page II-97, Section E.I.A. the Draft states: "Information on coastal productivity throughout the region is inadequate and in need of further study." This may potentially be an area to evaluate for future special studies or recommendations to groups conducting research in this area to concentrate their activities to investigate some of the information needs.

Raised by: State of South Carolina

Response: We concur.

Issue No. E-16: Both terns and pelicans have rookeries at the Cape Romain Migratory Bird Refuge (including Bulls Bay). Brown pelicans referenced at Bulls Bay and Seabrook Island are located in South Carolina, not in Georgia as stated in the DEIS.

Raised by: State of South Carolina

Response: This additional information has been incorporated into Section II.E.1.f.

Issue No. E-17: It is mere conjecture that only 5% of the proposed lease tracts contain live bottom areas. An adequate study of these areas must be conducted before any such quantification can be made.

Raised by: State of South Carolina

Response: As the DES goes on to say in the first paragraph of page II-116, "...it is likely that more of these...areas will

be discovered...''. We agree that further study is required, and is underway.

Issue No. E-18: The last sentence of the second paragraph of page II-94 is misleading in that it implies that the phytoplankton species listed in Table E-1 are the only abundant species when the table lists only those species found during one cruise in January, when species abundance and diversity are at their lowest. Also, no dinoflagellates are listed in the table despite the remark on page II-94 that one species was dominant in the the summer.

Raised by: State of South Carolina

Response: Although the title of Table E-1 makes it clear that the abundance is for January, the sentence in question has been changed to clarify it also. The unidentified dinoflagellate was apparently not found to be abundant in January.

Issue No. E-19: Additional studies of the impact of oil and gas operations on phytoplankton (and this by extension, on the entire marine and estuarine food web) should be conducted.

Raised by: State of South Carolina

Response: We agree, and such studies are discussed under the comments received for Section I.C.3. Issue No. E-20: The section on benthos is not complete. The various works of Caull and Tietjen are not cited.

Raised by: State of South Carolina Response: Although not specifically cited, the works mentioned were considered in the discussion, see Roberts, 1974. Unfortunately, in publications of this type not all the research on a subject can be referenced to or even included.

Issue No. E-21: Much recent information on bird habitat such as Southern Bald Eagle nesting areas, osprey nesting sites, and Pelican loafing areas is available, but not included.

Raised by: State of South Carolina

Response: It is our goal to incorporate in the EIS the best available and most recent information. We are requesting the information referred to and will incorporate it into our studies as soon as it is revised and evaluated.

Issue No. E-22: Endangered and threatened species discussed are only those on Federal lists, and State species as such are not treated.

Raised by: State of South Carolina

Response: Additional information has been incorporated into Section II.E.2.c. of the FES.

Issue No. E-23: This section should identify the status of each species or population of marine mammal found in/or adjacent to the proposed sale area. The information provided is incomplete, inadequately documented, and, in some cases, misleading or incorrect.

Raised by: Marine Mammal Commission

Response: The DES has indicated generally the types of marine mammals in the area of the proposed sale. It is not the purpose of this statement to give a detailed status analysis of each species, this type of data would not lend to a greater understanding of the impacts of oil and gas leasing on marine mammals of the area. The data that is included in this section indicates the major species found in the area of the proposed sale. In view of the fact that Table E-11 indicated misleading information the table has been eliminated. The data for this compilation was taken from Robert, 1974 and the Department of Commerce, 1976.

Issue No. E-24: Statements and inferences related to the Marine Mammal Protection Act are inaccurate, as well as misleading. In enacting the Marine Mammal Protection Act, Congress recognized that ''marine mammals have proven themselves to be resources of great international significance, aesthetic and recreational as well as economic...'' and that ''certain species and population stocks of marine mammals are, or may be, in danger of extinction or depletion as a result of man's activities''. This paragraph implies, however, that marine mammals have no value other than economic, and that Congress enacted the Marine Mammal Protection Act because ''...they (marine mammals) all have an aesthetic significance that has been widely publicized''. The DEIS, as exemplified by this paragraph, fails to identify either the economic or aesthetic value of marine mammals, or to recognize that commercial exploitation and habitat loss already have had a significant impact on certain species or populations. Although Table E-11 lists five endangered species, no mention is made as to how these species came to be endangered.

Raised by: Marine Mammal Commission

Response: The text has been revised to indicate that marine mammals are resources of great international significance of aesthetic and recreational value as well as economic value. It's also noted that some population species of marine mammals are in danger of extention or depletion because of man's activities. Within the last several years a greater public interest in marine mammals has caused legislation to be written and passed for marine mammal protection. Therefore, although publicity may not have directly aided in the enactment of the Marine Mammal Protection Act of 1972 it certainly did not hinder and most probably brought the problems to light. The economic significance of marine mammals is focused around whaling which does not occur in the area of the proposed sale, therefore, it was not addressed.

Information was not presented in the statement concerning how these species came to be endangered. The evidence that is presently available indicates that this depletion was mostly from commercial exploitation and in some cases habitat loss. There is no evidence that offshore oil and gas operations has contributed to the loss of marine mammals. Although direct oil contact can have serious consequences for individual marine mammals. It is noted here that the manatee which once inhabited the Gulf of Mexico, is no longer found in a large part of this area. It appears that this occurred before oil and gas development in the Federal waters of the Gulf of Mexico.

Issue No. E-25: The statement that ''there is no evidence to suggest that the fluctuations in food stock have affected the cetaceans, and weather plays a minor role in their population dynamics'' is misleading because it implies that fluctuations have not affected cetaceans. The relationship between the abundance of most marine mammal populations and their prey species is largely unknown. Similarly, it is not known how weather affects the reproduction and survival of marine mammals. Therefore, without citing relevant studies, it is inappropriate to assert that weather plays a minor role in marine mammal population dynamics.

Raised by: Marine Mammal Commission

Response: This statement simply indicates that there have not been any conclusive studies that show that fluctuations in food stock have affected cetaceans or what effect weather plays on the reproduction of marine mammals,

("...there is no evidence to suggest..."). However, the text has been changed so that this point is clarified.

Issue No. E-26: The statement that "these species (presumably meaning manatees and bottlenose dolphins) are probably the most vulnerable of all marine mammals to man's activities..." is accurate only if it refers specifically to marine mammals in the proposed sale area. If it refers to marine mammals in general, several other species (e.g., the sea otter, gray seal, etc.) should be mentioned as equally vulnerable.

Raised by: Marine Mammal Commission

Response: It has been stated in that paragraph that this EIS is only concerned with the marine mammal species in the proposed sale area. ("Within this study area...")

Issue No. E-27: The second sentence makes no sense, probably because one or more lines have been omitted: —i.e., "These whales are the black right whale and the humpback whale are considered endangered and the fin whale is considered vulnerable by an international group (IUCN, 1972)". The phrase "no dolphins, pinnipeds, or odontocetes" is ambiguous because the cetacean suborder Odontoceti includes dolphins or porpoises, as well as sperm whales and other toothed whales.

Raised by: Marine Mammal Commission

Response: The text has been changed to clarify these points.

Issue No. E-28: The adjective "feral" refers to domestic animals that have reverted to a wild state. It is not an appropriate adjective to describe species that have escaped from captivity. More precise terms are "exogenous" for the California sea lion and "extralimital strays" for the hooded seal. The harbor seal is a "natural" inhabitant of the area, and may be seasonally common as far south as North Carolina (Unpublished data, Dr. James Mead, Smithsonian Institution). It is conceivable that the seasonal migrants are juveniles from more northerly populations and it therefore is possible that breeding populations, as far north as New England, could be impacted adversely by activities in the proposed sale area.

Raised by: Marine Mammal Commission

Response: The observations have been included in the text. Dr. Mead of the Smithsonian Institute will be contacted for further information.

Issue No. E-29: The DES fails to discuss why some marine mammals are now endangered.

Raised by: Marine Mammal Commission

Response: The purpose of the EIS is to discuss and evaluate possible environmental impacts on marine mammals, not to discuss why some species of marine mammals are endangered.

Issue No. E-30: The humpback whale is "considered stable in the study area", and it is stated that "during winter they migrate southward to Bermuda, the Bahamas and the West Indies to mate and calve". These statements incorrectly imply that the humpback whale is a summer resident of the proposed lease area. In truth, it moves through, or adjacent to, the lease area on its northward and southward migrations, and more detailed information on its movements is needed to assess the potential impact of the proposed sale.

Raised by: Marine Mammal Commission

Response: This information has been corrected in the text.

Issue No. E-31: In the paragraph on sei whales, the statement that "...this mammal is near the level of a viable population size and therefore potentially on the verge of decline" is incomprehensible.

Raised by: Marine Mammal Commission

Response: This statement has been removed from the text.

Issue No. E-32: The discussion of manatees is an almost verbatim repetition of the discussion on page II-113 and, like the earlier discussion, is superficial.

Raised by: Marine Mammal Commission

Response: Additional information pertaining to possible impacts on manatees has been incorporated into Section III.B.5.

Issue No. E-33: The first sentence states that "twenty-two species of cetaceans, including three endangered species...have been sighted in recent times (the last 50 years) off the South Atlantic states". However, Table E-11 lists 24 species of cetaceans, five of which are endangered and does not indicate that some species have not been sighted during the last 50 years.

Raised by: Marine Mammal Commission

Response: This statement has been clarified. Table E-11 has been eliminated.

Issue No. E-34: Documentation must be provided for the statement that "the pigmy sperm whale and the goosebeaked whale, for example, have long been termed as rare species, but recent evidence (namely greater observational effort) suggests that they are, in fact, rather common".

Raised by: Marine Mammal Commission

Response: The text has been changed to read: "The pygmy sperm whale and the goosebeaked whale have long been termed rare species but recent evidence (greater observational efforts) suggest that they are not as uncommon as once believed", Morris Roberts. A Socio-Economic Environmental Baseline Study for the South Atlantic Region between Cape Hatteras, North Carolina and Cape Canaveral, Florida. Vol. III. Chemical and Biological Oceanography. Virginia Institute of Marine Science, Gloucester Point, Virginia. 1974.

Issue No. F-1: The best available and safest mode of transporting oil and gas ashore must be required in a special stipulation for leases in frontier areas.

Raised by: Natural Resource Defense Council

Response: Special stipulations are listed in Section IV.D. and if implemented will require the best and safest modes of transportation.

Issue No. F-2: The recreational qualities of barrier islands should be emphasized.

Raised by: National Resources Defense Council

Response: Section II.G.6. appropriately described and gives proper emphasis to the recreation qualities of barrier islands.

Issue No. G-1: There is seemingly a contradiction between the discussion of major pipelines for natural gas and a table describing petroleum products pipelines on Page II-169 on the DES.

Raised by: Federal Power Commission

Response: There is no contradiction between the terms "southeastern U.S. coastal region" and "southeastern states". The major products pipelines located in the southeastern states are not located in the coastal regions of those states. This has been explained clearly in the FES.

Issue No. G-2: An inventory of the transportation facilities of the area is given, however, the following questions should be answered considering both high and low production scenarios.

— What excess transportation and storage capacity does the area have, if any?

- What additional storage and transportation facilities are likely to be required by the area?
- What social, economic and environmental effects are likely to be produced by the use of available storage and transportation systems or what will be the impact of the needed additional facilities?
- Considering the shortage of oil pipelines in the area, what are probable ocean and land pipeline requirements and possible pipeline routes for the area?

Raised by: Environmental Protection Agency

Response: The inventory of transportation facilities was provided as an indication of the present oil handling facilities as selected points along the South Atlantic coast. Although some information became available as to the amount of excess capacity at some facilities during the research conducted for preparation of this impact statement, complete tabulations were not available. There are postulated increases in population expected to take place in the South Atlantic states during future years as a result of current migration patterns. Thus, the amount of excess transportation or storage capacity that may be present at some future date, when possible oil and gas production from the South Atlantic OCS would require storage or transportation is problematical.

For purposes of estimating socioeconomic and environmental economic effects that may result from proposed Sale 43, additional terminal facilities were assumed to be required for sale related production. Although specific locations for pipeline routes cannot be identified at this time, hypothetical landfalls were identified in the draft impact statement. To the extent that existing storage and transportation facilities can be utilized for OCS production, the estimated impacts will be reduced. The assumptions are discussed in more detail in Appendix K of the impact statement.

Issue No. G-3: Of the total fish landed in the Southeastern United States what portion was from commercial operations and from sports fishing?

Raised by: Environmental Protection Agency

Response: Presumably the question is directed to Table G-15 on Page II-183 of the DEIS. These are commercial landing figures and the table title has been corrected to reflect this.

Issue No. G-4: Clarification is needed on the existence of South Atlantic refineries, traffic separation, and fairways.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: Refer to FES Section II.J. for a description of petroleum refining activities in the South Atlantic. The FES II.G.1., Ocean Shipping, contains a clarification of the Coast Guard's intentions regarding fairways. The same section in both the DES and FES are correct in stating that there are no fairways established in the South Atlantic.

Issue No. G-5: Because of its controlling depth in excess of 30 feet, Port Canaveral should have been identified as a larger port.

Raised by: State of Florida

Response: Section II.G.1. has been reworded in the FES to clarify the meaning of "larger port". Generally "large" is not merely a function of channel depth. See Table G-8, Section II.G. for Port Canaveral freight traffic.

Issue No. G-6: Coast Guard procedures and policies on shipping fairways should be indicated.

Raised by: Department of Transportation, Coast Guard

Response: This information has been incorporated into the text.

Issue No. G-7: Hydrocarbon emissions from fuel storage to service the increase in ocean going vessels will develop. The increased tanker traffic will contribute particulates to the ambient air. This should be given a more detailed evaluation in the final EIS.

Raised by: State of South Carolina

Response: This information has been requested.

Issue No. G-8: Availability of helicopter facilities was not mentioned in II.G.1.

Raised by: State of South Carolina

Response: Discussion of this subject is included in the FES.

Issue No. G-9: Several natural areas of concern to the South Carolina Wildlife and Marine Resources Department were not identified in Sec. II.G.6.

Raised by: State of South Carolina

Response: Because of the broad coverage of this statement and the potential for only minor impacts to onshore natural areas we have limited our discussion of natural area resources solely to a brief description of them as a class in Section II. We have attempted to specifically identify on Visuals 1N and 1S only existing and nominated areas to the Registered Natural Landmarks Program. Many other areas such as South Carolina's Capers and Turtle Islands, Santee Coastal Reserve and T.A. Yawkey Devise are important natural areas but are not specifically identified in this statement.

Issue No. G-10: In regards to unknown undersea cultural resources the archaeological resource potential will increase as one moves closer to the shore, especially off major riverline systems.

Raised by: State of South Carolina

Response: Comment noted and included in text.

Issue No. G-11: Solid waste disposal in the Charleston area may be a problem as increases in population develop in this area as a consequence of OCS activities.

Raised by: State of South Carolina

Response: The SEAS model indicated that there would be less than 1% increase in population as a result of offshore oil and gas exploration, therefore, there should not be any serious increase in the solid waste problem.

Issue No. G-12: The statement that tires are no longer being used for artificial reefs is not correct. The Marine Resources Division is still using tires extensively for the construction of fishing reefs.

Raised by: State of South Carolina

Response: The descriptive section of the impact statement has been shortened to indicate only general aspects of solid waste disposal (tires) along the South Atlantic coast.

Issue No. G-13: The most important commercial species of shrimp have been misidentified by scientific names.

Raised by: State of South Carolina

Response: The mistake has been corrected.

Issue No. G-14: Organisms such as the bay anchovy (*Anchoa mitchilli*) were omitted from the discussion of oligohaline systems.

Raised by: State of South Carolina

Response: As stated in the introduction to Section II.F.4. the ensuing discussion was based on the work of Copeland et al (1974). In that publication the bay anchovy (*Anchoa mitchilli*) was not listed. However, we realize the bay anchovies in many estuaries are the most abundant fish, and the text has been changed to correct this omission.

Issue No. G-15: The possibility of sonic booms in the sale area has been brought to our attention.

Raised by: Assistant Secretary of Defense

Response: The section on Military Use of the Continental Shelf, II.G.4., has been changed to reflect the possibility of sonic booms.

Issue No. G-16: EPA's revision of the ocean dumping regulations should be reviewed.

Raised by: State of South Carolina

Response: The ocean dumping regulations have been reviewed.

Issue No. G-17: A safeguard to protect the coastal environment is needed. The State of South Carolina should be actively involved in planning and decision making.

Raised by: State of South Carolina

Response: Refer to the letter to the Governor of South Carolina from the Secretary of the Interior (see Section IX.5.).

Issue No. G-18: The potential for shipwrecks in South Carolina waters is understated in Sec. II.G.6.

Raised by: State of South Carolina

Response: We concur with your comment which is well documented with reference source material indicating the probable occurrence of many historic shipwrecks along South Carolina's coastline especially in the vicinity of Charleston, Georgetown, and Port Royal. The FEIS affords proper emphasis to South Carolina's probable shipwreck sensitivity areas.

Issue No. G-19: Section II.G.8. page II-216 of DES has words missing from the last paragraph.

Raised by: State of South Carolina

Response: The missing word has been inserted in the FES.

Issue No. G-20: Several reviewers recommended BLM should acquire a data base that will permit development of predictive models or cultural resource sensitivity zones. Such an information source should define the most likely areas on the South Atlantic OCS where historic shipwrecks and drowned prehistoric archaeological sites might be located.

Raised by: State of South Carolina, Dept. of Archives and History; State of Georgia, Department of Natural Resources; University of South Carolina

Response: This office in cooperation with the National Park Service is proposing that a comprehensive cultural resources evaluation of the South Atlantic be funded so that a single reliable basis can be determined and utilized for assessing potential impacts from offshore petroleum development. Until an acceptable basis for projecting occurrence of cultural resource material on the South Atlantic OCS has been determined all tracts will be considered by the BLM OCS Office Manager as potentially harboring cultural resources.

Issue No. H-1: TKN stands for total kieldahl nitrogen.

Raised by: State of South Carolina

Response: Correction has been made in the text.

Issue No. H-2: The South Carolina Department of Health and Environmental Control administers programs such that any offshore development with a wastewater discharge would have to comply with national standards of performance for new point source discharges which must also comply with State/Federal water quality standards. Various programs and permitting activities, including the National Pollutant Discharge Elimination System permit program, have been delegated to this Agency by the Environmental Protection Agency. This NPDES program with its subsequent controls would apply to all types of onshore development to include any processing facilities or other types of secondary development. Further, DHEC must certify all projects that required Federal licenses or permits to insure consistency with certain provisions of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500). This certification would again insure proper control technology and achievement of water quality standards within State waters. Activities covered by this certification include dredging and filling in the tidelands areas and the construction of various structures within State territorial waters. Certain critical areas of concern such as open shellfish harvesting areas would be subject to special protection.

Raised by: State of South Carolina

Response: Each state has permitting programs that assures that onshore development comply with State and and Federal water quality standards. The responsibilities of these agencies, it is assumed, will be met under existing law.

Issue No. H-3: The description of South Carolina's basin is inadequate. To our knowledge the Morgan River does not show "severe contravention of water quality standards", as it is still classified as SA. The Cambahee and Coosaw Rivers are also SA streams to the best of our knowledge.

Reference is made to this section concerning the degradated water quality in Segments 03-09-20 and 03-08-14. For up-to-date information, the City of Beaufort is no longer discharging raw sewage but has a secondary wastewater treatment system, and Charleston Harbor is generally meeting water quality standards.

Raised by: State of South Carolina

Response: After review of the descriptive water quality section the detailed information that was originally included in this section has been eliminated, because it was not evaluative as it should have been. It was depicted that this much detail was not necessary to adequately depict the general impact on water quality of the area. The states are presently working on water quality studies and are improving the facilities in the state. The general water quality for each state should meet state and Federal standards by July, 1977.

Issue No. H-4: There does not appear to be any consideration given to the long term effects of urban development sprawl that always brings concomitant closure of shellfish growing waters. This is due to the inherent run-off induced by concrete and asphalt and natural gravitational flow of surface water to estuarine waters.

Raised by: State of South Carolina

Response: As indicated in the SEAS model the population increase along the South Atlantic coast as a result of the proposed offshore oil and gas lease sale would be less

than 1%. In view of this, there has not been much concern directed toward impacts to be expected from urban sprawl. Also, the harmful effects of pavement runoff is being studied by the U.S. Department of Agriculture Research Service (ARS) in University Park, Pennsylvania, in coordination with the Soil Conservation Service (SCS). A five-year study is currently underway on the effects of porous asphalt on hydrology.

Issue No. H-5: Note the Yadkin-Pee Dee River Basin extends into South Carolina as well as North Carolina and covers a critical area in South Carolina (tourism in Grand Strand area). More substantive information should be available on water quality classification by sub-basins for South Carolina.

Raised by: State of South Carolina

Response: The descriptive section has been edited to indicate only the general water quality impacts to be expected along the South Atlantic coast. Specific information has been used to portray an overall outlook on the water quality problems of certain areas. It is also noted that each state is presently updating areawide 208 plans to comply with the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500).

Issue No. I-1: The final statement should contain summary ambient air quality data consisting of annual averages and the highest two readings. The evaluation of potential new sources is complicated by a lack of coastal monitoring sites that measure non-methane hydrocarbons and oxidants.

Raised by: Environmental Protection Agency

Response: Table I-8, Section II.1. indicates the counties with the highest amounts of emissions and the source and point source of these emissions. This table was derived from the emission estimates from Table I-3 through I-7. The asterisks indicate the recorded emissions levels in the particular area. Table I-3 takes in the entire South Atlantic coast and ranks the areas of highest emissions for this entire area. Table I-4 through I-7 takes each state separately and designates the county with the highest emission levels. Therefore, we believe this subject has been adequately covered in the FES.

Issue No. I-2: Corrections for total 1975 carbon monoxide readings of 5,824,308 tons/yr. changes to 1,399,752 tons/yr., and reference to emissions data for AQCR 168 and Washington County, North Carolina should be made.

Raised by: Environmental Protection Agency

Response: These corrections have been made in the text.

Issue No. I-3: There has been an updating of information found in Table I-9 p. II-249 of the DES. The final EIS should include this data.

Raised by: Environmental Protection Agency

Response: The tables have been omitted from the FES. We feel that neither the tables, nor updating of these tables would add validity to the evaluation in the statement.

Issue No. I-4: The discussion of hydrocarbon air emissions is not considered complete. Since 1973, additional air quality monitoring must have been conducted in the coastal AQCR's and second-high ozone levels should be available. Such data, in addition to the total HC emission levels is needed to utilize a roll back model to determine the adverse effects of increased HC emissions from tanker, production and storage operations on ambient air quality.

Raised by: Department of Transportation

Response: Data needed to respond to this comment has been requested from EPA.

Issue No. I-5: Utilization of AQCR data may have been compiled using mostly urban survey data and may not adequately portray the air pollution emissions problems of a particular region.

Raised by: State of South Carolina

Response: We concur with this statement. This problem was mentioned in the DES Section II. p. 237. "However, the data that is presented is not a true picture of the air quality of a given AQCR or county. Most of the data available are from urban centers."

Issue No. I-6: Construction of any facility which emits air contaminants may have to secure emission trade-offs from existing facilities prior to approval to construct the new facility.

Raised by: State of South Carolina Department of the Army

Response: See response in Section V - Issue No. K-1.

Issue No. J-1: More emphasis on the national need for OCS oil and gas development should be stressed. Increasing national dependence and future reliance on expensive synthetic fuels should be discussed.

Raised by: Federal Power Commission

Response: Additional information has been incorporated into this section of the FES.

Issue No. J-2: The work force requirements of new refineries, 500-600, and petrochemical complexes, 14,000-85,400 seem excessive in light of the degree of automation in new refineries and primary petrochemical complexes. The lack of an established infrastructure, thus requiring outside the area contractors for major service functions at a refinery, and the unlikelihood of new secondary and end product petrochemical complexes at least initially, indicate significant lower employment degrees would be more realistic. A more likely new petroleum based industrial facility would be a natural gas desulfurization/processing facility, should be discussed both here and in Section III.7.

Raised by: Department of Transportation

Response: During the year 1972, 323 petroleum refineries in the U.S. employed 100,800 persons, an average of 312 persons per refinery. In the west south central region, 103 establishments employed 43,300 persons, an average of 420 persons. Bureau of Mines data (January 1, 1973), list 252 operating petroleum refineries in the U.S. Using this figure as a basis for an estimate, indicates an average of 400 employees per refinery. Contract work required at a refinery site could require additional workers not classified as direct employees of an oil refining firm. The work force requirements noted above for a refinery were obtained from the summary of the study prepared by the Office of Planning and Budget, State of Georgia. The figures 14,000-85,400 refer to work force size in areas selected by the State of North Carolina as representative types of locale where a hypothetical petrocomplex might be located. Gas processing plants have been included in the scenarios postulated for this impact statement.

Issue No. J-3: Additional information regarding the Coastal Plains Regional Commission should be added.

Raised by: State of South Carolina

Response: Additional information has been added to Section II.J.1.

potential cumulative impacts of leasing in the South Atlantic OCS area will be addressed in any EIS prepared for potential lease sale No. 54 and 56.

Issue No. A-9: Since the biological baseline has not been determined for this area, assessment of the degree of recovery from an oil spill cannot be considered to be accurate. Further, there should be information regarding the effect of initial mortality on productivity at higher trophic levels.

Raised by: Environmental Protection Agency

Response: Table A-10 "A summary of several major oil spills followed by studies of their biological impact" is intended as a summary of historical data on oil spills. In the absence of baseline data, from a similar environment, within the same geographical area is generally accepted. Unless there is severe and extensive initial mortality on producers, the effects on higher trophic levels would be immeasurable.

Issue No. A-10: The factors that are likely to influence the location of onshore facilities should be ranked in order of importance. This would assist a more realistic projection and appraisal of probable facility sites and attendant environmental impacts.

Raised by: Environmental Protection Agency

Response: It is believed that some of the more significant factors that would influence the location of onshore facilities have been mentioned in the statement. Probably the most important unknown at the present time is the location of commercially exploitable oil and gas deposits, although bases for use during exploratory drilling will be required prior to the discovery of oil and gas. A ranking of the factors would probably reflect individual preferences, rather than objective evaluation and has therefore been omitted.

Issue No. A-11: The DES does not adequately describe the impacts resulting from the transport of oil by tanker. Analysis of what nearshore areas must be avoided by tankers and trajectories taken from likely tanker routes should be included.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.
Ivan Teper, Atlanta, Ga.

Response: No analysis of trajectories resulting from tanker spills were included in Section III, but the Oil Spill Risk Analysis, Appendix M, does consider spills from points A, B, and C, along possible tankers routes. The risk of tanker spills is also predicted in various scenarios. It is not likely that the area affected would be substantially increased because tanker transportation routes would be between lease areas and shore. Tanker movement of oil as an alternative is examined in Section VIII.E.

Issue No. A-12: The DES does not assess the potential cost of this action on the recreation and fishery resources of the coastal area of Florida and North Carolina. Since the study determined that these two areas are most likely to be reached by oil this must be considered.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: These two impacts have been reexamined and improved in Section III.D. and V.A., D. & E. Also, when discussing impacts such as this it is necessary to discuss the length of time required to reach sensitive areas, p. 197, Appendix M, by the oil spill.

Issue No. A-13: A trajectory analysis should be done for tanker routes. A model that shows the oil effects of a tanker oil spill in a harbor such as Charleston or Savannah should be analysed.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: In effect this was done. Trajectories were computed for three transportation spill sites between the lease areas and shore. Also, an oil spill analysis similar to that addressed in the comment already exists for Charleston Harbor. This analysis can be found CEQ, 1974, Vol. 5.

Issue No. A-14: Karst topography is discussed on page II-28. The Potential Geologic Hazards section appears to be inconsistent with the Section III.2., page III-6, Effects of Potential Geologic Hazards on Offshore Operations.

Raised by: Department of Commerce

Response: Section III.2., page III-6, "Effects of Potential Geologic Hazards on Offshore Operations" minimizes the risk to drilling because detailed hazard surveys should detect areas of shallow karst topography. Undoubtedly semi-submersibles will be used in areas of karst topography.

Issue No. A-15: Use of semi-submersible rigs as opposed to the bottom-supported jack-up rigs.

Raised by: Department of Commerce

Response: South Atlantic OCS Order No. 2, states that the operator must furnish evidence of the fitness of the drilling platforms and its capability under the environmental conditions expected.

Issue No. A-16: Why are Pacific coast statistics concerning oil and gas well blowouts ignored? The "average" spill ignores a giant spill more than 2,000,000 gals. which could have more than an average impact.

Raised by: Department of Commerce

Response: Pacific coast drilling statistics do not reflect the years continuous drilling experience found in the Gulf of Mexico. The Gulf of Mexico drilling statistics, as was pointed out, are more representative of the possible drilling environment found in this lease area. In response to the second part, the term "average" does not ignore the large volume spill. If there had been a spill of the magnitude that was mentioned, then that data point would have been averaged into the estimate. The oil spill risk analysis does project on the probability of a spill greater than 1,000 bbls.

Issue No. A-17: What is the impact of blowouts on marine biota?

Raised by: Fish & Wildlife Service

Response: Little information with regard to the impact of a blowout on marine biota is available. However, Dr. James Brooks of Texas A & M is now conducting a study for Pennzoil Marine Division on their November 5, 1976 blowout in Block Number A-563, High Island, South Addition Area. The final report was released in May, 1977.

Issue No. A-18: An oil spill trajectory model should be included for tanker routes.

Raised by: Ivan Teper, Atlanta, Ga.

Response: The reviewer is referred to Appendix M, including Tables 2, 3 and 4. Figure 1 identifies the hypothetical spill locations used in the oil spill risk model. Sites defined by A, B, and C represent spill locations by pipelines or tankers. Spill frequency estimates were then determined from past OCS experience in the case of pipelines and U.S. Coast Guard spill statistics for

tankers. Spill trajectories were also computed from these locations.

Issue No. A-19: A major flaw in the wording of the draft EIS was the implicit assumption in any discussion of costs and benefits that there is indeed oil to be found in the South Atlantic OCS. The industry's experience in the MAFLA area should underscore the importance of caution in any such generalizations. Exploration of the Sale 43 area carries a major cost in terms of irretrievable committment of fuel and other resources, as well as environmental damage to a degree that is not yet accurately quantifiable, and may well result in no discoveries of producable hydrocarbons. In other words, the costs are certainties and the benefits only possibilities, and while this is not an argument against oil drilling per se, it should be recognized that this is the nature of the enterprise in the EIS.

Raised by: Florida Audubon Society

Response: The uncertainty of finding commercial quantities of oil and gas is discussed in Section III.A.8.

Issue No. A-20: This project's understanding of Coast Guard regulations is that they apply to oil concentrations of the discharge and require slop tanks. They do not specifically require LOT (Load on Top); however, as a practical measure, the discharge limitations can only be met by LOT.

Raised by: Department of Transportation, Coast Guard

Response: The text has been changed to reflect this comment.

Issue No. A-21: The analysis of oil spill probabilities does not specifically identify spills associated with "offshore oil terminals" in the text although one or two are expected, and terminals are included in Table A-5.1. Since SPM's (Single Point Mooring) are the most likely type of offshore oil terminals and unloading ports have historically had about one spill in every 17 vessel calls (with a significantly poorer record for loading facilities), they would represent a significant percentage of the expected oil spill incidents.

Raised by: Department of Transportation

Response: This information has been added to Section III.A.4.

Issue No. A-22: Although at the time of the article the ECOL refinery was an independent, Marathon Oil is in the process of or has recently purchased this facility.

Raised by: Department of Transportation

Response: The comment is accurate. Plans have been announced to construct additional capacity at this refinery in order to increase the variety of products manufactured.

Issue No. A-23: Proper care should be taken during drilling operations to preserve the integrity of freshwater aquifers.

Raised by: State of South Carolina

Response: South Atlantic OCS Order No. 2 provides protection for freshwater aquifers in the surface casing program as outlined on page 50, Section B.(2)., Surface casing. It is clear that the principal artesian aquifer extends offshore beneath the continental shelf. Freshwater from this aquifer flowed from the drill pipe at Joides Hole J-1 on the inner shelf 40 km off Jacksonville, and slightly saline water was obtained from J-2 on the outer shelf 120 km from the coast, Dillon et al. 1975.

Issue No. A-24: Special studies of "live" bottom areas, and lease stipulations protecting them should be enacted.

Raised by: State of South Carolina

Response: Please refer to Section I, Issue C-4 for information concerning special studies of "live bottoms". Discussion of a lease stipulation relating to these areas were held with the U.S. Fish and Wildlife Service, National Park Service, U.S. Geological Survey and the South Atlantic states. The proposed stipulation which would protect "live" bottoms is listed in Section IV.D.

Issue No. A-25: Adequate attention has not been given to sand waves, Southeast Georgia Embayment.

Raised by: State of South Carolina

Response: Although sand waves are shown in Figure A-5 (Section II.A.) preliminary geophysical and bathymetric surveying by the USGS indicate that south of Cape Hatteras the height and frequency of sand waves are considerably less than those north of Cape Hatteras. However, hazard surveys run prior to drilling operations should delineate sand wave areas. The rapidity with which these features move is yet to be documented.

Issue No. A-26: A chart showing projections of oil spills for the South Atlantic would be worthwhile inserting in this narrative section. This is more useful than Table A-4, on page III-10. (Note: Page III-14 is a summary table for South Atlantic hypothetical tanker spills).

Raised by: State of South Carolina

Response: This section contains narrative where probabilities of accident occurrences are projected from past OCS experience in the Gulf of Mexico. Figures 4 through 7 of Appendix M give hypothetical oil spill trajectories for the four seasons of the year.

Issue No. A-27: The information on tanker accidents should be updated to include data through 1976. The statement misleads the reader since mention is made of the Argo Merchant accident in December 1976, but the data used to draw conclusions is for years prior to 1974.

Raised by: State of South Carolina

Response: Additional information pertaining to tanker accidents has been incorporated into Section III.A.4.d. See Tables A-5.1 and A-5.2.

Issue No. A-28: CEQ data, to my knowledge, has no verification on estimates of natural phenomena damaging offshore structures. Exercise caution when utilizing this data. Several events must occur simultaneously to produce a spill under CEQ's projections, plus failure of the sub-surface safety valves (0.96 probability of reliability). These conditions seem unrealistically severe.

Raised by: State of South Carolina

Response: We agree with this comment. However, this data presents a worst case projection.

Issue No. A-29: Neither the MIT or DOI oil spill models consider the effect of "weathering" (including other degradation and evaporation) or dispersion. They also are based on no cleanup attempts. These are major oversites in these models. Models should utilize "spills of opportunity" for verification, when possible.

Raised by: State of South Carolina

Response: Little is known about the quantitative aspects of changes due to weathering at this time. Also, the amount of spilled oil cleaned up in past spill situations is low in relation to volume spilled. Thus, the analysis uses the worst case assumption.

Issue No. A-30: A discussion of the CBI plant proposed for Beaufort County, South Carolina should be included.

Raised by: State of South Carolina

Response: A description of the proposed Chicago Bridge and Iron plant has been included in Section III.A.7.e.

Issue No. A-3l: The State of South Carolina pointed out that experience gained in Sale No. 43 could provide the state with valuable planning data.

Raised by: State of South Carolina

Response: An addition has been made to Section III.A.8.a.

Issue No. A-32: The biological impacts of oil spills should be examined to include up-to-date information on the effects of recent spills such as the Argo Merchant and Falmouth Bay spills.

Raised by: State of South Carolina

Response: Oil spill impacts are discussed throughout Section III.B. through III.E., and specifically in Sections III.A.4., III.A.6., and in Appendix I. The final impact of the Argo Merchant spill is not yet determined, but preliminary indications are that there has been little permanent damage to biological communities (see also Section III.A.4.). The Falmouth Bay spill apparently referred to occurred in 1969 (by the tanker "Florida") and consisted to 4,500 barrels of No. 2 fuel oil. Such a spill of refined oil is unlikely to occur as a result of this proposed sale, however the subject is discussed in Section III.A.6. We believe our discussion of spills and their effects are adequate.

Issue No. A-33: Page III-31, Table A-11 is inadequately explained.

Raised by: State of South Carolina

Response: The table has been clarified.

Issue No. A-34: The possibility of impacts from the proposed lease sale on the islands of the Bahamas has not been addressed. It is recognized that the distance between the southernmost boundary of the area and the Bahamas is perhaps several hundred miles. Nevertheless, a massive blowout, or more likely, the increased tanker traffic moving from the area into the Caribbean, might affect the Bahamas. Accordingly, we would suggest that a specific reference to the Bahamas be included in the Draft even if only to acknowledge that there is such a remote possibility of impacts that these are not considered to be of significant potential consequence.

Raised by: Department of State

Response: A discussion of possible impacts on the Bahamas has been incorporated into Section VIII.

Issue No. B-1: The DES does not adequately assess the impact of an oil spill on live bottom areas.

Raised by: University of North Carolina, Dirk Frankenberg

Response: We believe the discussion of the impacts of an oil spill on live bottom and other benthic areas contained in Sections III.A.4., III.B.3., III.B.7. and in Appendix I are adequately given the distance the shallow live bottom areas are from the proposed tracts. Also, see response to Issue No. A-24 (Section III.)

Issue No. B-2: Table A-6 is lucidly interpreted to assess the likelihood of oil spills caused by oil platform collapse, this treatment contains both data and interpretation of the data. Most of the DEIS contains either only the data; or, at best, the data supplemented with some unexplained estimates about the presumed qualitative nature of an environmental impact (see pages III-50-51 for an example of unexplained estimates of impacts on pelagic bird populations).

Raised by: University of North Carolina, Dirk Frankenburg

Response: We have revised the impact discussion on pelagic birds in Section III.B.

Issue No. B-3: Whales listed in Table E-11 gives a misleading assumption concerning the population of the species. These should read "no data".

Raised by: Endangered Species Productions Marine Mammal Commission

Response: The material indicated in this section was derived from Roberts, 1974, and the Department of Commerce, 1976. As indicated there is not enough available information to determine the population distribution accurately and therefore any figures that have been indicated might not be accurate. This category has been removed from the section and it has been noted that data is not readily available to determine the population of marine mammals in the proposed area.

Issue No. B-4: The statement that oil spills would affect only individuals, not cetacean groups, is incorrect.

Raised by: Endangered Species Productions

Response: It is true that certain species of marine mammals do travel in herds and have a herd leader, such as pilot whales. If anything were to cause the herd leader to be killed or beached the possibility of the herd following or becoming disoriented is highly probable. Therefore, if the herd leader were affected by an oil spill it is possible that the herd as a whole could be affected. Species that do not form herds such as the larger cetaceans would only be affected as the individual animals are affected.

Issue No. B-5: Increase in shipping traffic would have an impact on the manatee, as it already is the largest factor in the decline of the species. Construction of shore facilities for offshore production would be harmful to the manatee. There is no evidence that the manatee would avoid direct contact with an oil spill.

Raised by: Endangered Species Productions

Response: This view has been expressed in the DES and the effect on this endangered species has been further evaluated in Section III.D.5.

Issue No. B-6: The air quality analysis should be upgraded to include professionally acceptable modeling or dispersion analysis consistent with the state-of-the-art to delineate the range of downwind concentrations of pollutants from the upset conditions discussed in the statement.

Raised by: State of Georgia

Response: If an oil spill were to occur in the proposed area of exploration, the probability of emissions from evaporation reaching the coastline is highly improbable since the tracts range from 48 to 120 kilometers (30 to 75 miles). The approximate emissions from a blowout with 1,000 bbls. of oil released has been indicated in Section III.B.9.

Issue No. B-7: The distance which sediment may be moved by bottom currents and still produce an impact should be discussed.

Raised by: Environmental Protection Agency

Response: For additional information regarding the regional movement of surface sediment see Hollister, 1973. No detailed information is available on bottom currents and their relationship to how far sediments travel and produce impact.

Issue No. B-8: Studies are needed to provide bioassay data on effects of drilling muds on specific local benthic species.

Raised by: Environmental Protection Agency

Response: BLM does not have a fate and effects study in process, but a study is planned—see response to issue C-7 (Section I).

Issue No. B-9: Oil impacts on specific spawning and fishing banks, and hard bottoms are not discussed.

Raised by: Environmental Protection Agency University of North Carolina, Dirk Frankenberg

Response: Site specific research on oil impacts on spawning and fishing banks is largely lacking. Predictive discussions based on available data are covered in III.B.7. With respect to hard bottom areas, see responses to Issues Nos. A-24 and B-1 (Section III).

Issue No. B-10: The section in Chapter III considering the impact on offshore air quality on pages III-52 and 53 should provide typical emission estimates for various pollutants from fossil fuel equipment (e.g., electric generators) on the drilling platform. The Final EIS should provide hydrocarbon emission estimates and rates for individual components and operation of petroleum transportation and storage facilities. This should include, but not be limited to, platform storage, valve leaks, tanker or barge venting, ballasting and purging, etc.

Raised by: Environmental Protection Agency

Response: The EPA Research Lab in Durham, N.C. is presently compiling data with regard to production of oil and gas from offshore areas. This report entitled "Engineering Assessment of the Technology Used in Development and Production of Oil and Gas from Offshore Areas" is presently being revised and should be available late in 1977. This report contains the information mentioned in this comment.

Issue No. B-11: Figure A-5 should be modified to include transport and transformation in the area where atmospheric oxidation occurs.

Raised by: Environmental Protection Agency

Response: This subject is discussed in Section III.B.9.

Issue No. B-12: The cumulative impact of emissions on air quality should be discussed further.

Raised by: Environmental Protection Agency

Response: The information that has been detailed in Section III.B.9. indicates the offshore sources that would result in emissions offshore. However, data is not available to give any accurate figure as to the amount of emissions on the OCS. The Environmental Protection Agency is presently compiling data that will give a better understanding of offshore emissions. At present, data indicates (SEAS model) that the offshore air mass would disperse the small amounts of emissions that would be generated as a result of offshore operations.

Issue No. B-13: How accurately can the negative impacts of OCS operations on the marine environment be predicted?

Raised by: The Sierra Club, Joseph LeConte Chapter, Raleigh, N.C.

Response: The absolute accuracy of any prediction varies with the effluent of activity and the specific marine ecosystems and is never truly known until tested. However, the scientific documentation of the effects of oil and gas operations in marine systems provides an adequate predictive basis for the decision making.

Issue No. B-14: Effects of an oil spill on the marine biota, including effects on community composition, trophic level composition, toxicity and ecosystem stability are not adequately assessed in the DES.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: We believe the discussion of these subjects throughout Section III of the DES is adequate considering what is known of these subjects and the area in question. On-going research in these areas should provide a basis for a more thorough analysis of these potential problems. In the event the proposed lease sale is held and exploration is successful, Secretary Andrus has stated that a development stage EIS will be prepared for the South Atlantic OCS area. Results of current studies will be available for incorporation in such EIS.

Issue No. B-15: There is a contradiction stating that there were no dead whales reported following the Santa Barbara oil spill.

Raised by: National Park Service Marine Mammal Commission

Response: The statement has been removed. It should be noted that the death of these marine mammals was not a direct result of the oil spill, but probably due to natural causes.

Issue No. B-18: Contact with, inhalation, and ingestion of spilled oil would have a detrimental impact on manatee. Oil spills would jeopardize critical habitat.

Raised by: Fish and Wildlife Service

Response: This section has been changed to reflect these views.

Issue No. B-19: A discussion of toxic effects of drilling fluids during the exploratory phase was made. However, no mention was made of toxicity from drilling fluids during development and production phase. A discussion of biocides and potentially toxic mud additives is recommended.

Raised by: Fish and Wildlife Service

Response: The wording has been changed in the text to reflect the possibility of toxic effects during development and production phases of oil and gas operations.

Issue No. B-20: The statement that "the maximum size of a turbidity plume in the Gulf of Mexico was 20 m wide and 800 m long" is misleading or erroneous. We have seen photographs of a turbidity plume from a drilling rig offshore Texas that extended well over a mile in length.

Raised by: Fish and Wildlife Service

Response: This has been corrected in the statement to reflect the above comment.

Issue No. B-21: More recent analyses of the impacts of deepwater ports are contained in the Coast Guard final EIS's on the LOOP and SEADOCK projects. These documents, which also include the status of other deepwater port proposals, were filed with CEQ on December 17, 1976.

Raised by: Department of Transportation, Coast Guard.

Response: This information has been added to the text.

Issue No. B-22: The construction of a petroleum refinery or a gas processing facility will attract other industries related to the petroleum industry (inorganic chemical plants, etc.). These other plants may not be affected directly by PSD and NSPS regulations, but they may have particulate, organic, SO_2, or odorous emissions that could adversely affect the air quality of the coastal region. Each facility, refinery or related facility, will add to the particulate levels in the air from the attendant transportation emissions and fugitive dust

generated by the facility. This should be given a more detailed evaluation in the final EIS.

Raised by: State of South Carolina

Response: It is not known at this time whether there will be a need for a refinery on the South Atlantic coast or any auxiliary facilities. It is not the purpose of this impact statement to review such operations in detail. The impact section indicates the type of facilities that could cause the most serious pollution problems, gas processing plants and oil refineries. These are brought out to alert the states that without proper investigations prior to siting of these types of facilities subsequent problems could arise. See reference to a development stage EIS in the response to Issue B-14 (Section III).

Issue No. B-23: Check temperature figures of lighter fractions for evaporation. 4827°?

Raised by: State of South Carolina

Response: This correction has been made in the text.

Issue No. B-24: Page III-17, Sec. 7. Offshore platforms may serve as artificial reefs. They may possibly increase populations or may only serve as accumulation points for the fisheries resources providing additional protection and food sources.

Raised by: State of South Carolina

Response: The point of the discussion (Sec. III.E.7.) on the reefal effect of offshore structures was that they do in fact attract and/or harbor fish which can result in a favorable impact on sport fishing. There is some not only attract some fish but contribute to an increase in productivity of other fish. References cited in the FEIS were specifically chosen to document scientific support for both theories.

Issue No. B-25: The DEIS, as exemplified by Table E-11, simply states that certain species of marine mammals are migratory, inferring that they move into or through the proposed sale area on a seasonal basis. Such general information is of little use for predicting the impact of the proposed sale. The discussion of the right whale (p. II-138), for example, provides no specific information on when, where, or why the species moves through the proposed sale area.

Raised by: Marine Mammal Commission

Response: The general information that indicates that marine mammals are migratory species that move through the proposed area is important because it points out that the placement of structures could have an impact on their migration routes.

Issue No. B-26: Knowledge of the right whale's migration is particularly important because this species is endangered throughout its range and the loss of even a few animals might have a significant adverse impact. Right whales with very young calves have been seen close to shore along the east coast of Florida (personal communication from Randall R. Reeves, Smithsonian Institution to Robert J. Hofman, Marine Mammal Commission), suggesting that the species' productivity could be affected by the proposed sale.

Raised by: Marine Mammal Commission

Response: The text of the FES has been changed to acknowledge this possible impact on right whales. See Section III.B.5.

Issue No. B-27: No mention is made of the possibility that oil could foul baleen plates, thus impairing the feeding efficiency of baleen whales.

Raised by: Marine Mammal Commission

Response: This has been incorporated into the text.

Issue No. B-28: It is stated that "twenty-two species of cetaceans, including three endangered species...have been sighted in recent times (the last 50 years) off the South Atlantic states". However, Table E-11 lists 24 species of cetaceans, five of which are endangered, and does not indicate that some species have not been sighted during the last 50 years.

Raised by: Marine Mammal Commission

Response: The text has been corrected to reflect the above comment.

Issue No. B-29: Certain species of large cetaceans migrate thousands of miles to forage in relatively localized areas characterized by high primary and secondary productivity. These feeding areas are not randomly or uniformly distributed in the world's oceans and it therefore is incorrect to conclude that "...because of the large area foraged, this (localized decreases or redistributions in the abundance of prey species) would not be expected to limit overall availability of food supplies for cetaceans" or that "...uptake by cetaceans of substances generated by routine operations would be expected on only a limited basis because of their large forage area". Without a comprehensive knowledge of species-specific feeding areas within the proposed lease area, and knowledge of how related activities might affect each species in the food web, there is no basis for predicting second order effects on marine mammals.

Raised by: Marine Mammal Commission

Response: Since the species-specific feeding areas are unknown at this time the above mentioned statement was removed from the text.

Issue No. B-30: Of the three species that are discussed (California sea lions, harbor seals, and hooded seals), only the harbor seal is indigenous to the proposed sale area. Although there are no known breeding sites for the harbor seal in the proposed sale area, there are insufficient data presented to justify the statement that "impact on individuals would not be expected to impact populations". As noted earlier, significant numbers of harbor seals may occasionally be found as far south as North Carolina and it therefore is conceivable that certain populations of harbor seals could be impacted as a result of the proposed sale.

Raised by: Marine Mammal Commission

Response: The text has been changed to incorporate this information.

Issue No. B-31: It is noted in the impact section that "there has been no investigations (sic) performed regarding the results of the manatee ingesting contaminated food", and that "due to the mobility of the manatee they would probably avoid any direct contact with an oil spill". Manatees, unlike other marine mammals, are herbivores and ingestion of oil, or oil contaminated food, conceivably could affect intestinal bacteria needed to digest otherwise indigestible vegetation. Recognition of the need for studies to determine the effects of ingesting oil, or oil contaminated food, is conspicuously absent in the DEIS. Furthermore, there is no empirical evidence to suggest that manatees are able to detect and/or avoid oil, and to imply otherwise is irresponsible.

Raised by: Marine Mammal Commission

Response: The section has been changed to reflect these views. Also, a proposal for a special study to be conducted regarding marine mammals has been submitted to the Department's Washington Office Staff.

Issue No. B-32: On Page III-50, Section 7. (DEIS), fish communities are also associated with hard bottoms and a reference to the section and impacts on nekton should be made or the potential problems addressed in this section.

Raised by: State of South Carolina

Response: Rather than repeat the discussion of impacts on fishes in this section, the text has been amended to refer back to Section III.B.4., Impact on Nekton.

Issue No. C-1: No specific assessment of the potential impact of oil and gas activities on North Carolina scallop populations is included.

Raised by: University of North Carolina, Dirk Frankenberg

Response: A discussion of this potential impact has been incorporated into the text.

Issue No. C-2: The EIS should treat the impacts of petroleum exploitation on estuarine fishes.

Raised by: State of Georgia

Response: There are relatively few fishes that spend their entire life cycle in the estuary. An additional section concerning the impacts on estuaries (III.D.2.) has been added to the statement. This section more specifically addresses the impacts on estuarine fishes.

Issue No. C-3: What will be the short term and long term adverse effect on fisheries? What is the potential loss to fishermen and consumers?

Raised by: Environmental Protection Agency, University of North Carolina, Dirk Frankenberg State of Georgia

Response: The adverse effect both short-term and long-term have been evaluated in light of present knowledge. Section III, Issue No. A-12. If the proposed lease sale is held and exploration is successful, more specific information on this subject should be available for analysis in a development stage EIS prepared for the South Atlantic OCS area. No. A-12.

Issue No. C-4: Impacts of tanker shipping routes and frequency of trips were not assessed.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: Because the South Atlantic has no established fairways, the open seas policy still stands and tanker routes cannot be predetermined. However, unlimited tanker movement under a hypothetical scenario of tanker transport is evaluated in Section VIII.E.1. (Scenario A). It is logical to assume that the extra impetus of the Gulf Stream would be utilized to its fullest by any northbound traffic. The number of tanker trips are estimated in Section III.C.2.

Issue No. C-5: The decrease of foreign crude import would decrease South Atlantic port traffic, this should be discussed in the FES.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: The word "increase" in the fourth sentence of paragraph 2 of DES page III-55 has been changed to "decrease". The similar discussion on DES page III-58 has also been clarified.

Issue No. C-6: The need for established navigational fairways in the South Atlantic either before or after OCS exploration activities has been brought up by several entities, both pro and con.

Raised by: Department of Transportation, Coast Guard, American Institute of Merchant Shipping, Washington, D.C., Natural Resources Defense Council, Inc., New York, N.Y., State of South Carolina

Response: The Corps of Engineers and the U.S. Coast Guard are currently exploring this matter which is within their jurisdiction. The Corps is presently examining comments on their published "Guidelines for Permits for Exploratory Drilling Operations" for the Southern California OCS area. Presumably, these guidelines could also be used for the Atlantic areas as well. The Coast Guard basically plans to support the aforementioned. "Guidelines" as well as designated fairways when and if the number of structures exceed that safe for shipping. It must be noted, however, that the use of these fairways, if established, would remain voluntary.

Issue No. C-7: No mention is made of Savannah as a possible site for development of operations activities related to servicing offshore facilities.

Raised by: Department of Transportation, Coast Guard

Response: A full discussion of the development scenarios is included in Appendix K, and a summary has been added to Section III.E.1.

Issue No. C-8: A discrepancy in damage dollar figures for vessel-platform collisions has been noted.

Raised by: Department of Transportation

Response: The typographical error in III.C.3. has been corrected in the FES.

Issue No. C-9: Clarification is needed on the accountability of vessels in navigational fairways.

Raised by: Department of Transportation, Coast Guard

Response: Section III.C.3. of the FES has been altered to emphasize that vessels are generally free to either use or ignore navigational fairways at their own risk.

Issue No. C-10: Are the disposal piles recolonized by the same species that were eliminated by burial or are these recolonizing animals perhaps opportunistic species?

Raised by: State of South Carolina

Response: Generally, the same species will recolonize an area, depending on what type of community existed before burial. Succession, of course, will occur.

Issue No. C-11: Fish communities are also associated with hard bottoms and a reference to the impacts on nekton should be made or the potential problems addressed in this section.

Raised by: State of South Carolina

Response: Additional information has been incorporated into Sections III.B.4. Nekton and III.C.6., Commercial Fisheries of the FES.

Issue No. C-12: The impact of tanker refined oil spills on the environment was not considered.

Raised by: State of South Carolina

Response: A brief description of environmental effects of refined oil can be found on DES Page III-28. More involved impact assessment was not warranted because of the support facility needs estimates based on the USGS resource estimate. The Table on DES Page I-4 graphically shows these support needs. Although no oil refineries are expected to be built as a result of proposed Sale 43, the possibility is discussed in several potential scenarios of development in Section VIII.E. of the FES. Also, see response to Issue No. A-32 (Section III).

Issue No. C-13: Even though it is so minor an impact, the impact of oil and gas OCS activity on shipping should be quantified.

Raised by: State of South Carolina

Response: Figure C-1 in Section III of the FEIS graphically displays the lack of correlation between numbers of platforms and numbers of platform/vessel accidents. The total number of supply vessels needed, and thus, their quantitative correlation to probabilities of vessel collision, also can not be clearly estimated. As Table A-1 on DES page III-31 indicates, nine boats are estimated as the need for each onshore supply base. Depending on structure location, these bases can serve one or several of the 10 to 25 platforms estimated to be developed from proposed lease sale No. 43. As can be seen, a probability quantification based on so many broad range variables would not be meaningful. Because of the estimated minor impact that OCS activity would have on shipping and shipping accidents, this quantification was not attempted.

Issue No. C-14: Discussion on the impact of oil and gas exploration on ports in the South Atlantic does not seem to be adequate, i.e., only three ports appeared to be assessed.

Raised by: State of South Carolina

Response: Changes in the FES III.C.1. clarify that the discussion of impacts on ports is not meant to pertain to the three ports mentioned by name only, rather that these may be general impacts expected in any port. Other locations and their site-specific impacts are examined in VIII.E. under Possible Scenarios of Development.

Issue No. C-15: Some reference should be included to the potential increase in ocean dumping of dredged material off South Atlantic ports, especially Charleston. Changing regulations on ocean disposal appear to make this more likely in the near future, and the establishment of new ocean dumping sites is a likelihood.

Raised by: State of South Carolina

Response: There probably will not be an increase in dredging activities in major ports as a result of this proposed sale, therefore, discussion of a potential increase in ocean dumping of dredged material off South Atlantic ports did not seem warranted. If the proposed lease sale is held and exploration is successful, and if, at that time, increased dredging activities appear likely, an analysis of that activity would be incorporated into a development stage EIS for the South Atlantic OCS area.

Issue No. D-1: There are several contradictory statements concerning what is the primary and most serious impact on manatee, habitat destruction or increased ship traffic. It is also stated that in view of the population distribution of manatee, loss due to increased ship traffic is unlikely.

Raised by: Endangered Species Productions, Marine Mammal Commission

Response: This section of the text has been clarified.

Issue No. D-2: What is a paucity of cetaceans?

Raised by: Endangered Species Productions

Response: This paragraph has been revised in the FES.

Issue No. D-3: With respect to onshore impacts, there is an apparent lack of a methodology to predict induced development and subsequent secondary impacts on air and water quality from OCS developmental activities. For example, a method such as the GEMLUP (Growth Effects of Major Land Use Project) is needed to estimate the land use and infrastructure impacts of such facilities.

Raised by: Environmental Protection Agency

Response: According to Tom McCurdy, project officer on the GEMLUP Model, this model was produced in order to estimate the secondary land use impact (commercial and residential) that might be expected within a 10,000 square foot area surrounding an industrial development. The model utilizes several input estimates such as value added and jobs in order to estimate the secondary land use requirements. The results are expressed as gross public and private requirements. A modification of the GEMLUP Model is now being developed. This modification will permit estimates of service facilities required (such as sewage treatment plants) for areas defined in a different manner than the area definition included in the original GEMLUP model. The SEAS model discussed in the text is designed to estimate the impact on air and water quality resulting from industrial, commercial, and residential activity. Our information indicates that the GEMLUP model is not a means of predicting air and water quality changes.

Issue No. D-4: It is indicated that the only pollutant for which violations of ambient air quality are occurring in particulate matter, SO_2 violations are also occurring especially in the Jacksonville, Fla. area.

Raised by: Environmental Protection Agency

Response: The text has been changed to reflect the information provided.

Issue No. D-5: The impacts on drinking water should be discussed.

Raised by: The Sierra Club, Joseph LeConte Chapter, Raleigh, N.C.

Response: A new section has been added, Impact on Potable Water, Section III.D.9.

Issue No. D-6: Additional information pertaining to the impact on sea turtles should be incorporated into the FES.

Raised by: Department of Commerce, State of South Carolina, U.S. Fish and Wildlife Service

Response: Additional information on sea turtles furnished by NMFS has been incorporated into Section III.D.5.

Issue No. D-7: Barrier Islands protect valuable coastal marshes which are vanishing at an alarming rate due to various types of development. Potential impacts to these resources are not given adequate attention, especially Sapelo Estuary.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: These resources are valuable, and additional information has been incorporated into Section III.D.2. which discusses the potential impact on these resources.

Issue No. D-8: Impacts of potential oil spills from tankers traveling along the intra-coastal waterway on wetlands and estuaries were not assessed.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: This impact was not weighed because oil-laden tankers could not physically travel up the waterway and long distance barge travel up the waterway is not as economically sound as open ocean tanker travel.

Issue No. D-9: An EIS is needed between the exploration and development phase.

Raised by: Florida Department of Administration

Response: See response to Issue No. D-2 (Section I).

Issue No. D-10: Some air quality will deteriorate due to OCS oil use. The assumption is made that overall air quality

will increase because auto emission standards will be made more stringent, but progress in upgrading these standards may not be fast enough to counter pollution due to OCS oil and gas use.

Raised by: Department of Commerce

Response: The basis for this statement is not that there would be a less serious emissions problems from transportation because of projected stringent control on automobiles and trucks, but that after construction activities the amount of vehicles within a given area will decrease. This is indicated by the decline of emissions over time in relation to the base year. Therefore, taking both these factors into consideration, the overall air quality would not deteriorate over time.

Issue No. D-11: Besides the occasional occurrence of an oil spill, the major impact of oil and gas development on water quality will be associated with the transport and refining of the extracted petroleum on or nearshore. The environmental pressures associated with almost every aspect of secondary development will require additional expenditures of state and local resources in order to maintain water quality consistent with established water uses.

Raised by: State of South Carolina

Response: This is discussed in Section II.D.9., Impact on Potable Water.

Issue No. D-12: Proper planning on the states' part relating to designated pipeline corridors may minimize the impacts on wetlands due to pipeline construction. The "push" or "shove" method of construction is the superior method because it imposes fewer impacts to the environment.

Raised by: State of South Carolina

Response: We agree. The section in question (Section III.D.2.) has been revised to reflect these views.

Issue No. D-13: "...total increase in number of employed civilian persons range from 1.79 to 4.38". It was felt that this statement required more explanation.

Raised by: State of South Carolina

Response: The statement originally read "... the relationship between the number of persons directly employed... and the total increase in the number of employed civilian persons ranged from 1.79 to 4.38. This was changed to read "the mathematical ratio between the number of persons... and the total increase..." This ratio was intended to show the change in the employment multiplier effect associated with different scenarios.

Issue No. D-14: The Coastal Zone Management programs should be involved in siting of support facilities and secondary development with large support from local communities.

Raised by: State of South Carolina

Response: Before CZM program approval, proposed OCS Order No. 15 (Appendix G) and proposed stipulation No. 4 would involve the local communities in siting of support facilities and secondary development related to offshore oil and gas development. Also appropriate local zoning or land use regulations would apply. Upon approval of the state's Coastal Zone Management Plan (estimated at least by spring of 1979 for these South Atlantic States) the consistency provision (Section 307) of the CZMA will be operative. The requirement includes directive to OCS Lessees that are submitting a plan of exploration, development, or production to the Department of Interior to submit the same to the affected state(s). A certification of consistency of this activity with the state's CZM plan must be included as well as a full description of the activity and its affect on land and water uses in the state's coastal zone. Also, all information required by the state to backup the consistency certification will be included. The state is then required to pursue public input prior to a decision on the adequacy of the consistency certification. Local governmental entities will at that time have further input into locational and other impacts of OCS related onshore development.

Issue No. D-15: Page III-70, Section D.5. Several wildlife species are discussed but the entire category of migratory waterfowl seems to have been omitted.

Raised by: State of South Carolina

Response: Additional discussion of the impacts on migratory waterfowl has been included in Section III.D.4.

Issue No. D-16: "SEAS model indicates...nutrient nitrate and phosphate would increase less than six during the peak years..." less than six what?

Raised by: State of South Carolina

Response: Text has been changed to read less than 6%.

Issue No. D-17: Climatological conditions will affect air quality. These should be addressed in this discussion.

Raised by: State of South Carolina

Response: This topic is discussed in Section II.D. These conditions have been taken into consideration.

Issue No. D-18: Incomplete sentence in listing cities (second paragraph) "Charleston, S.C.; Savannah..."

Raised by: State of South Carolina

Response: The text has been corrected.

Issue No. D-19: The phraseology used to describe dredged material as spoil is sometimes misleading. There are numerous uses for the material ranging from construction purposes to marsh development. Therefore, the term spoil should be replaced with the term dredged material.

Raised by: Department of the Army, Corps of Engineers

Response: This suggestion has been incorporated into Section III.D.2. of the FES.

Issue No. D-20: The discussion on pages III-66 and III-67 of the DES paints a bleak picture regarding the impacts of oil on birds in offshore environs, quoting such statistics as (1) at least a 57% probability that an oil spill occurring within the proposed lease area could affect the endangered Arctic peregrine falcon, and (2) a 23% probability that an oil spill near Currituck and Pamlico Sound in North Carolina would affect such species as the Greater Snow Goose and the Whistling Swan. Then, amazingly, the section is summarized by the statement that "it is not expected that there would be any serious impact on the bird population of the South Atlantic as a result of this proposed sale or any future sale in the area". How can this statement possibly be justified?

Raised by: Fish and Wildlife Service

Response: Oceanic diving birds are apparently the species most seriously affected by oil spills (MIT Sea Grant Report 77-4 and Argo Merchant Oil Spill Report, U.S. Dept. of Comm., March, 1977). Section III.D.4.a. has been revised to reflect the serious potential impact on bird species.

Issue No. D-21: A discussion should be presented in the onshore endangered species section on OCS activities which could impact designated critical habitats and the resultant Section III. consultation procedures that would be required under the Endangered Species Act of 1973.

Raised by: Fish and Wildlife Service

Response: A discussion pertaining to critical habitats has been incorporated into Section III.D.5.

Issue No. D-22: The brief discussion of impacts on sea turtles is totally inadequate. See our previous discussion of this topic.

Raised by: Fish and Wildlife Service

Response: Section III.D.5. has been revised to incorporate additional FWS information.

Issue No. D-23: The statement that "any impacts to endangered species . . . would be minor, temporary, and confined to small specific areas, and a few individual animals so that only a small part of the population in question would be affected" shows a basic misunderstanding of the entire endangered species concept. We wish to stress that, with endangered species, the loss of even a "small part of the population" can be of major consequence to the survival of the species.

Raised by: Fish and Wildlife Service

Response: Section III.D.5. has been revised to reflect this potential consequence.

Issue No. D-24: The statement that "pollution from a leased site is considered remote due to the distance the tracts are from the estuarine areas" is contradicted by a statement on page III-50 that states the "oil spill trajectory . . . indicates that the projected route could go towards the Florida coast". The probability of an oil spill impacting manatee habitat should be calculated and included on Table A-8 on page III-21.

Raised by: Marine Mammal Commission

Response: The endangered species section has been rewritten to clarify the point concerning oil spill trajectory findings.

Issue No. D-25: Although Table E-11 lists five cetacean species that have been declared endangered under the Endangered Species Act, only the potential impact on manatees is discussed in this section. Furthermore, there are discrepancies between the information presented in this section, and that presented on pages II-113 and III-50.

Raised by: Marine Mammal Commission

Response: Additional information has been incorporated into Section III.B.5.

Issue No. E-1: With respect to the economics of OCS development, it is still possible to glean useful information from the available data. Two steps will overcome many of the uncertainties raised:

(1) Consider several hypothetical production sites in the lease area, with multiple transportation and storage scenarios for each sites.

(2) Consider the entire range of reserves from 95% to 5% probabilities of occurrence. The results of this type of analysis for one site in the Gulf of Alaska are illustrated in Figure 5 of the enclosed paper. As a companion to this chart, similar results are depicted in Figure 6 of the risk analysis.

The present cost and spill risk data base is imperfect, however, the suggested methodology offers a logical way to combine the best available cost and spill risk information into a format that can be used for rational decision making. Perhaps lending additional credibility to this hypothesis it should be noted that a paper describing this methodology has been selected for publication in the Journal of Petroleum Technology.

Raised by: Applied Management Science

Response: Possible transportation, storage and processing scenarios have been discussed in Sections III.E.5. and VIII.E. of the FES. We believe the economic impact of these scenarios have been sufficiently discussed in the FES.

Issue No. E-2: The final EIS should spell out which existing regulations will guarantee review of onshore development and address the question whether there could possibly be onshore development resulting from offshore leasing which does not provide for state review.

Raised by: State of South Carolina, Department of Archives and History, State of South Carolina

Response: Section 307 (16 USC 1451), of the Coastal Zone Management Act, as amended provides that the lessee must submit a proposed plan of development to the affected coastal State for review, once the State has an approved coastal zone management program. A lessee must also submit a certificate of consistency of the proposed plan with the States coastal zone management program. The state would have a period of six months in which to review and submit comments to the Department on the proposed plan. Further, the FES discusses proposed stipulation No. 4 dealing with State review of exploratory activities on any leases issued, if proposed lease sale No. 43 is held, and proposed OCS Operating Order No. 15 dealing with State review of any development plan filed by OCS lessee (See Section IV and Appendix G). These requirements for State review would apply prior to approval of a State coastal zone management program. The stipulation and order would require the oil and gas lessee and make available to the states likely to be affected by exploration, development and production of the lease a plan of their proposed actions with emphasis on the onshore-nearshore implications of their plans. These plans would be reviewed by the states prior to final approval by the Federal government.

Should a potential or successful lessee decide to speculate on an onshore location (land purchase, for example) for future facility siting prior to the lease sale or approval of exploration or development plans the Federal government has no control over such actions. Such activities would be subject to State and local jurisdiction. The FEIS has been revised to clarify these existing and proposed requirements allowing for state review of offshore proposals which might impact cultural resources onshore or nearshore.

Issue No. E-3: The SHPO (State Historic Preservation Officer) will not be called in to review plans for onshore and nearshore facilities stimulated by offshore drilling unless those facilities are Federally funded or licensed. Additionally the SHPO serves only in an advisory capacity and is not responsible for state or Federal law designed to protect cultural resources. Under Federal law, the Federal agency responsible for a proposed action is responsible for protecting cultural resources.

Raised by: State of South Carolina, Department of Archives and History

Response: The Bureau of Land Management is the Federal agency responsible for identifying cultural resources potentially affected by OCS lease sales prior to lease sales. We consult the National Park Service, the Advisory Council on Historic Preservation Service, the Advisory Council on Historic Preservation and the SHPO's in states adjoining the proposed OCS lease area to determine national register sites and those possibly eligible for inclusion on the national register that might

be affected by the proposed lease sale. As noted by several commenting states, we cannot determine which tracts will be leased, which leased tracts will contain payable resources, or where and when accidents will occur. Thus, we cannot realistically project site specific onshore and nearshore impacts. We discuss in general terms the potential impact to offshore, nearshore shoreline historical sites which may be directly affected by the lease sale and make some projections on the probability of direct impact occurrence. Once leases have been granted the U.S. Geological Survey approves operational plans for exploration and development. BLM does issue permits for product transmission lines (pipelines) and we request comments from the SHPO when a line is proposed to come ashore. Stipulation No. 4 and OCS Order No. 15 are proposed to allow potentially affected states an opportunity to plan for predictable onshore impacts tied to exploration and development of payable lease tracts. We expect that the SHPO of the potentially affected states will be consulted by the governor as part of his official review of the proposed exploration and development plans should this stipulation and OCS Order be adopted.

Issue No. E-4: The draft EIS projects a probability that oil spills will impact a cultural site. The effect of this impact should not be limited to pollution of sites with oil but should include effects on the physical and biological environment that surrounds and are a part of historic and archaeological sites. In other words the impacts of oil spills on cultural resources are not fully alluded to in the impact statement.

Raised by: State of South Carolina, Department of Archives and History

Response: As was pointed out, there are many indirect influencing factors that could make a direct impact such as an oil spill on a National Register site much more severe than the apparent physical and aesthetic problem of direct pollution. These types of impacts are discussed throughout Section III. The text has been revised to indicate that primary impacts on a specific resource can cause or lead to severe and lasting secondary impacts, assuming the initial impact causing factor is not successfuly abated.

Issue No. E-5: Onshore support facilities developed in support of or as a result of offshore leasing can cause impacts to onshore cultural resources. Even though the map of the South Carolina Coast illustrates the density of historical and archaeological sites near the coast it does not show all the sites listed on the Statewide Historic Sites Inventory and Statewide Archaeological Sites Inventory.

Raised by: State of South Carolina, Department of Archives and History, State of Georgia

Response: It is our intent to have all historical and archaeological sites that are on the National Register or eligible for the National Register and that occur within the Coastal tidal zone or have shoreline frontage to be identified and discussed, as appropriate, in the environmental impact statement. Any such sites not on official registers maintained by the Department of the Interior and not identified by the States and certified by the SHPO as a potentially eligible register site were not included on the visuals.

Issue No. E-6: The draft EIS does not address inshore impacts of exploration activities. This is an especially serious omission, and should be remedied.

Raised by: State of Georgia

Response: Discussion of onshore impacts that might result from exploration activities has been noted in the discussions of impact on ports, shipping, military uses, land transportation, and air quality (Sec. III.D. and E.). Proposed special stipulation No. 4 provides information for submission by a lessee to affected coastal states relating to proposed exploration plans, and activities to be generated thereby.

Issue No. E-7: The State of Georgia is particularly concerned with onshore socio-economic impacts resulting from offshore operations. In view of the tremendous uncertainty of such impacts prior to exploratory results, the Draft was necessarily vague in this regard. For informational purposes, however, the State used certain data contained in the Draft to modify the Georgia Econometric Forecasting Model developed at the University of Georgia. This model allows us to categorize various changes according to type of industry and to gain better insight into such key parameters as employment, personal income, and tax revenues. We have furnished BLM representatives with the results of this analysis in the hope that future socio-economic assessments for OCS development will be along the same level of detail. Such assessments would be especially suitable for inclusion in supplemental EIS's by amplifying data contained in the Notices of Support for Offshore Activity filed by the industry in conjunction with their exploration plans. Similar notices of support activity will probably be required prior to development and production as part of Operating Order 15 (not yet completed). We would think that the Secretary of the Interior, prior to approving exploration and development plans, would similarly like to be aware of regional socio-economic impacts forecasted by such an econometric model.

Raised by: State of Georgia

Response: Some differences were noted between the forecasts developed in the various scenarios included within the draft impact statement and the results provided by the Georgia Econometric Forecasting Model. Additional data provided by Harris outputs have been incorporated into the impact statement.

Issue No. E-8: Biological stipulation needs to provide specific measures to be taken to protect live bottom systems.

Raised by: Environmental Protection Agency U.S. Fish & Wildlife Service State of Georgia

Response: A proposed stipulation has been designed to satisfy these requirements. This stipulation is listed in Sections IV.D. of the FES.

Issue No. E-9: It is suggested that a separate impact statement be developed and circulated for comment on each geographical land development or on shore use when details are known.

Raised by: Department of Health, Education and Welfare

Response: In the event the proposed lease sale is held and exploration is successful, Secretary Andrus has stated that a development stage EIS will be prepared for the South Atlantic OCS area.

Issue No. E-10: The increases shown for employed workers may be transient and not permanent. The BLM should compare the employment generated by OCS development with that generated by conservation efforts that would save as much net energy as might be produced from the South Atlantic OCS.

Raised by: The Sierra Club, Joseph LeConte Chapter, Raleigh, N.C.

Response: We believe the comparison referred to would not be meaningful at this time. The extent to which employment becomes permanent rather than transient would probably be dependent on the degree of success experienced during exploration and production activities, as well as the requirements for construction work. It should also be noted that in the event that commercial quantities of oil and/or gas were not found, no net energy would be produced.

Issue No. E-11: An additional problem with this section is the assumption that no refineries are needed and that a portion of the crude will go to the Mid-Atlantic refineries (III-29). This is the third Atlantic Draft Statement which assumes that the Mid-Atlantic refineries can accommodate the oil from a lease sale. However, the initial assumption in the Draft Statements was that OCS Sales would replace foreign crude. This DES must assess the impacts of increased refinery capacity, either in the Mid-Atlantic or South Atlantic, whichever the projections assumes to be the more likely location. Accompanying land use and air quality impacts from expanded refinery capacity must also be fully examined.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: Please refer to Section III.A.7.c. During the year 1975, refineries located in PAD District 1 (including the states of Delaware, Maryland, Florida, Georgia, Virginia, New Jersey, Rhode Island, New York, New Hampshire, Pennsylvania and West Virginia) received foreign crude oil in the amounts of 33 million barrels delivered by pipeline and 418 million barrels delivered by tankers and barges, for a total of approximately 451 million barrels, or an average rate of 1,235,616 barrels per day. During 1976 foreign crude oil receipts into PAD District 1 amounted to 1,415,000 barrels per day. Crude oil from other parts of the United States, principally from the states bordering the Gulf of Mexico, was received by the coastal states in PAD District 1 during 1975. Interstate shipments of domestic crude oil to District 1 refineries amounted to approximately 15 million barrels delivered by pipeline, 6 million barrels delivered by tankers, cars and trucks, and 34 million barrels delivered by tankers and barges. Referring only to the refinery receipts of foreign crude oil, delivered by tankers and barges to refineries located in PAD No. 1 during 1975, amounting to 418,319,000 barrels, the average daily receipts of foreign crude amounted to 1,146,277 barrels per day.

The daily rates of peak oil production estimated to result from OCS sale 40 and proposed sales 42 and 43 amount to a combined total ranging from 199,000 to 671,000 barrels per day, approximately 17% to 54% of the 1975 barge and tanker transported foreign crude oil imports to PAD District 1, if the peak production rates occurred simultaneously. If present sources of domestic crude oil supply for refineries in this area continue to decline in productivity, in the future a larger volume of foreign crude oil may be required for these refineries. The discussion on page III-29 (DES) mentioned existing refining capacity in the Gulf of Mexico area, and on the islands of the Caribbean Sea, as well as along the Atlantic seaboard. Expansion of domestic refining capacity as a result of Atlantic OCS sale No. 40 and proposed sales 42 and 43 referred to in the comment does not appear to be necessary. Refineries located in PAD District III (Alabama, Arkansas, Louisiana, Mississippi, New Mexico, and Texas) received approximately 432 million barrels of foreign crude oil by barge and tanker during 1975. This is at an approximate rate of 1,182,989 barrels per day.

A recent publication by the Mississippi Marine Resources Council (Wales et al, 1976) discusses land use requirements for petroleum refineries. Estimates range from 550 to 1200 acres for a 200,000 barrel a day complex. The Standard Oil Refinery at Pascagoula, Mississippi is presently operating on 900 acres of land with an additional 1,700 acres held for future expansion.

Some potential development scenarios discussed in the FES (Section VIII.E.) postulate the future presence of an oil refinery in Chatham County, GA. Comparison of this scenario with those in which no refinery was assumed to be present, yielded an estimate of the change in air quality due to refining operations. This estimate was provided by International Research and Technology Corporation with the use of the SEAS model. The conclusions reached were summarized on page III-72 of the draft EIS. It was assumed in the discussion of the hypothetical refinery that it might be built to refine oil from sources other than the area of proposed lease sale No. 43.

Issue No. E-12: Several commentors indicated the DEIS needs a stronger focus on the tourist industry. Desire for an economic evaluation attributed to existing tourist economies and assessment of economic losses likely to result from and oil spill affecting these economies were expressed.

Raised by: National Resources Defense Council, Inc., Department of Transportation

University of North Carolina, Dirk Frankenberg

State of South Carolina

Response: Additional information has been incorporated into Section III.G.8. of the FES.

Issue No. E-14: BLM fails to properly address the potential onshore impacts of OCS development in its impact statements. This criticism applies to proposed OCS Sale No. 43.

Raised by: U.S. Fish and Wildlife Service

Response: The onshore impacts of Scenario D were extensively covered in Section III (Impacts). The onshore impacts of Scenario D were pinpointed and examined in depth. The other possible scenarios are examined from an environmental point of view in Section VIII.E. of the FES.

Issue No. E-15: The Draft EIS does not fully cover the impact of short term population increases in areas which do not have sufficient services to deal with the increases.

Raised by: Ivan Teper, Atlanta, Ga.

Response: The impact of short term population increases is discussed in Section III.E.4. of the EIS. Additional site-specific information on population impacts can be examined in the development stage EIS.

Issue No. E-16: How will the new oil affect the oil economy and energy conservation.

Raised by: Ivan Teper, Atlanta, Ga.

Response: Based on the estimated daily rates of production that are anticipated from proposed OCS Sale No. 43, there will be an incremental addition to the nation's productive capacity over what may be experienced in the absence of the proposed sale. The Administrator's efforts to achieve greater energy conservation is a separate and distant goal of the National Energy Plan. Both conservation and increased domestic production of oil and gas are deemed necessary to achieve greater energy self-sufficiency.

Issue No. E-17: Care must be taken when interpreting and extrapolating data from the Harris Economic Model. Actual operations may or may not follow these relatively few scenarios.

Raised by: State of South Carolina

Response: This issue is discussed in the response to Issue No. E-21 (Section III).

Issue No. E-18: What possibility exists that Georgetown County, S.C. may have some of the spin-off development from offshore oil and gas operations.

Raised by: State of South Carolina

Response: In the final EIS, six additional development scenarios were added to the original five. These six additional possible paths of development are examined in Appendix K, Chapter IV. One of the additional scenarios, SCMAC, hypothesizes a gas processing plant and an operations base in Georgetown County, S.C. Employment income, residential construction, private investment and population impacts are examined out to 1996.

Issue No. E-19: What is the explanation for the negative effect on Williamsburg County in South Carolina offered in the draft EIS. Are there circumstances which could minimize these impacts?

Raised by: State of South Carolina

Response: It should be kept in mind that this potential negative effect on Williamsburg County is not a negative effect on the present situation but instead a decline in the number of employees and amount of private investment that might occur in Williamsburg without oil and gas development. The Harris Model uses, as a base, a projection of the total U.S. ecomony as it is expected to grow in the future. This base is then subtracted from the scenario results to show the impact of the hypothetical situation. Both the base case and the scenario are merely projections based on economic principles. One economic principle is that employees and private investments will shift to take advantage of higher wages and increased return on investments. Under the hypothetical development situation, OCS related activity will take place in areas other than Williamsburg County. This activity will cause jobs, raise wages and increase the rate of return on private investment. As a result, employees and private investment that might have gone to Williamsburg County will wind up in areas like Charles County.

Issue No. E-20: Page III-114 (DEIS) - assessing impacts of an oil spill on a shoreline is a bit unrealistic if the oil spill models do not account for containment or cleanup. Seasonality also will affect the potential impact.

Raised by: State of South Carolina

Response: The oil spill model did not account for containment in projecting quantity of pollutant likely to reach and affect shorelines. Mitigating measures such as cleanup will certainly diminish the short and long term impacts on a shoreline. As noted in individual impact discussions other factors such as seasonality, weathering, type of crude, climatic conditions, etc. can all affect the real impact of a spill on a shoreline and shoreline associated resources. In discussing the potential impact of an oil spill along the South Atlantic the probability of containment and season of occurrence were considered in assessing potential effects.

Issue No. E-21: The State of South Carolina (Socio Economic Committee Report) noted that the economic model projections may be misleading if interpreted as the only alternatives for development within the coastal zone, and noted that an explanation was needed pointing out the limitations of such scenarios and the difficulties in the extrapolation of the data as extremely accurate portrayals of the socio/economic development associated with offshore exploration and production.

Raised by: State of South Carolina

Response: The scenarios selected for inclusion in the draft impact statement were believed to represent a range of possible future developments, and do not imply that any scenario or necessarily that the range covered by this group of scenarios, is a completely accurate forecast of what will be experienced as a result of proposed Sale No. 43. The ranges recorded for various areas are believed to present a reasonable range of impacts that may be experienced, given the assumptions that must necessarily be made. Additional development scenarios have been completed, incorporating different assumptions. (See Section III.E.1. and Appendix K).

Issue No. F-1: The impact of beached oil on recreational use of beaches was not assessed.

Raised by: University of North Carolina, Dirk Frankenberg

Response: Section III.E.6. assesses the primary impact of recreational use on beaches affected by an oil spill and alludes to many of the secondary impacts that could occur assuming unsuccessful containment and cleanup efforts. See the response to Section III, Issue No. E-14 for rationale as to why additional economic quantification was not attempted in assessing these impacts.

Issue No. F-2: Oil spills could have a moderate to maximum potential impact on hatchling sea turtles, which are endangered species, and the matrix should reflect this.

Raised by: Department of Commerce

Response: We agree that oil spills could have a moderate to maximum potential impact on hatchling sea turtles, but the matrix is designed to reflect the impact on all of the endangered species of the area taken as a group and not a single group of species. However, additional information regarding the impact of oil spills on hatchling sea turtles has been incorporated in Section III.D.5.

Issue No. F-3: The matrix analysis indicates that an oil spill would have only a minimal effect on the littoral zone, yet certain pertinent publications on this subject were not referenced.

Raised by: State of South Carolina

Response: The conclusion method above is the result of the matrix analysis which takes into account such factors as the distance the littoral zone is from the potential oil producing regions. As discussed in Section III.D.1., fresh oil impinging on the littoral zone will certainly cause severe local damage; the matrix analysis reflects the belief that such a circumstance is unlikely. See Appendix J for an explanation of the matrix analysis procedure. Also, we relied heavily on the NAS publication (1975) Petroleum in the Marine Environment for our discussion, in which most of the papers mentioned were referenced.

Issues Concerning: Mitigating Measures Included In The Proposed Action

Issue No. A-1: The paragraph on Page IV-10 of the DEIS describing the FPC's jurisdictional responsibilities contains several minor inaccuracies - a substitute is proposed.

Raised by: Federal Power Commission

Response: The substitute proposed by FPC describes their duties in better detail and should be adopted. The change has been incorporated in the text.

Issue No. A-2: There appears to be too little time provided by Secretarial Order No. 2974 for BLM and FWS to review and respond to lessee plans under consideration for permits by the USGS.

Raised by: State of Georgia

Response: We believe the five and twenty working days time limitation for response under the Secretarial Order to be adequate. However, should situations arise in which more time is required, an appeal for an extension of time can be requested to a higher authority under the provisions of the Order.

Issue No. A-3: Under Secretarial Order No. 2974, states are not given an opportunity to receive information about nor to comment on decisions of the Department of the Interior which may impact them heavily. States should be afforded the opportunity to review these orders.

Raised by: State of Georgia

Response: Under proposed OCS Operating Order 15 (Appendix G) states would receive such information and would be allowed an opportunity to make comments and recommendations.

Issue No. A-4: Enforcement of the stipulations may be a problem because of an inadequate number of USGS inspectors. The draft EIS should include a proposed inspection schedule, information on manpower requirements of the schedule, a summary of available inspection capabilities, and a plan to meet the need for an adequate supply of inspectors. This shortcoming needs to be addressed in the final EIS.

Raised by: State of Georgia

Response: The Geological Survey inspection force in the Gulf of Mexico has increased from 7 technicians and 5 engineers in 1969 to 42 technicians and 16 engineers in 1976. During a recent three and one-half year period, more than 8,000 inspections of platforms and 54,000 inspections of well completions were made. Approximately 6,000 inspections of drilling rigs were made. The amount of personnel required, and the schedule of inspections that may be necessary as a result of proposed Sale No. 43 may be more accurately known if and when the producing capabilities of the area are better established.

Issue No. A-5: There should be a requirement for a supplemental environmental impact statement after exploration detailing additional environmental and socio-economic data and information not available for the Lease Sale Environmental Impact Statement.

Raised by: State of Florida, Department of Natural Resources

Response: Secretary Andrus has stated that a development stage EIS will be prepared for the South Atlantic OCS area. See Section IX.5.

Issue No. A-6: There should be a requirement for a larger state role in the review and decision-making process relative to the offshore development plans mandated by 30 CFR, Part 250.

Raised by: State of Florida

Response: The present requirements of 30 CFR, Part 250 have been included in Appendix H, and in Appendix G. Pursuant to 30 CFR, Part 250.34 lessee's are required to submit, to affected coastal states, development plans and pertinent information relative to onshore and nearshore facilities. The States have an opportunity to submit comments to the Department concerning the proposed development plans. See Final EIS Section IX.5. See also response to A-5 above.

Issue No. A-7: The statement regarding the inapplicability of EPA's National Pollutant Discharge Elimination System (NPDES) to waters of the contiguous zone and to floating craft or vessels is in error. These waters and these particular facilities are also included with EPA's authorities for regulations of point sources of pollution and will be subject to EPA's permitting requirements.

Raised by: Environmental Protection Agency

Response: Section IV.A.5. of the DES clearly states that NPDES is applicable to waters of the contiguous zone. If the issue relates to whether NPDES is applicable to the discharge of pollutants from vessels or other floating craft in the contiguous zone, the definition of "point source" is clearly broad enough to include vessels (33 U.S.C. 1362 (14)). However, the statement of inapplicability in the DEIS relates to "discharge of pollutants" which is clearly defined in 33 U.S.C. 1362 (12) as "and addition of any pollutant to the waters of the contiguous zone or the ocean from any point source other than a vessel or other floating craft." In view thereof, we believe that the DEIS is not in error. Discussions on the matter are now in progress between EPA and DOI.

Issue No. A-9: Since coordination among Federal agencies which share jurisdiction appear to be fragmented, what more effective modes of coordination of Federal management of the OCS are possible?

Raised by: Sierra Club, Joseph LeConte Chapter, Raleigh, N.C.

Response: As pointed out in Section IV.A. of the DEIS many Federal agencies have responsibilities in energy and environmental affairs. It has long been realized that many agencies have overlapping jurisdiction and in order to eliminate duplicate regulatory matters a Memorandum of Understanding is entered into between the agencies involved which sets forth their respective responsibilities. For example, Secretarial Order 2974 (Appendix E) was issued for this purpose. Legislation would be needed in order to totally eliminate the fragmentation referred to.

Issue No. A-11: The Regional Director, NMFS, should have an opportunity to review exploration and development plans before they are approved by the Supervisor.

Raised by: Department of Commerce

Response: It is our understanding that NMFS and USFWS have an arrangement whereby USFWS consults with NMFS before providing USGS with recommendations on such plans. We believe this procedure should satisfy the concern of NMFS.

Issue No. A-12: The initial directive issued by USGS concerning Secretarial Order 2974 should be published in the FES with an analysis of its impact upon the mineral leasing program.

Raised by: U.S. Fish and Wildlife Service

Response: The Secretarial Order 2974 as promulgated superceded individual bureau comments an insures the cooperation of the bureaus subject to the order.

Issue No. A-13: A detailed discussion of the Secretarial Order No. 2974 should be included in the DES.

Raised by: U.S. Fish and Wildlife Service

Response: We agree, and this has been done in Section IV.A.1.

Issue No. A-14: A discussion of the point raised on Page IV-1, paragraph 3 (i.e., that the stipulations are not legally binding unless approved by the Secretary and placed in the actual lease agreements issued as a result of the proposed sale). Many people that we have talked to are under the erroneous impression that, if a stipulation appears in the final environmental statement, it is legally binding upon lessees, however, as we have discovered a number of times in the Gulf of Mexico, this is not necessarily true. We feel that this point should be thoroughly discussed in the final environmental statement.

Raised by: U.S. Fish and Wildlife Service

Response: The stipulations referred to above are made a part of the DES for the purpose of indicating what the proposed action is and for receiving comments thereon. At this point they are not legally binding. The final version of the stipulations that would be applicable to a lease, if the sale is held, are set forth in the Notice of Lease Offer (43 CFR 3301.5) published by the Director in the Federal Register at least 30 days prior to the date of the sale. At that time all prospective bidders know that if they bid on a lease with a stipulation they will be subect to it if awarded the lease. The stipulation cannot be changed during this period and when the lease is awarded and executed by the lessee the stipulation then becomes legally binding on him at that time with his prior knowledge thereof.

In the textual discussion relative to the stipulations, it is clearly pointed out that the stipulations described in the EIS are being recommended to the Secretary for adoption in the event he decides to authorize the proposed lease sale.

Issue No. A-15: Page IV-4, paragraph 5. The statement that proposed South Atlantic OCS Operating Order No. 7 would "in effect eliminate the potential impacts on biological communities, water quality, commercial fisheries, offshore recreation.." is completely erroneous. Implementation of this proposed Operating Order might help to mitigate the impacts on these diverse areas, but they would not eliminate the potential impacts. Only cancellation of the proposed sale would eliminate these potential impacts.

Raised by: U.S. Fish and Wildlife Service

Response: Please see response to issue A-11, Section III. We agree, and the discussion of the proposed Order (Section IV.A.1.b.) has been revised.

Issue No. A-17: In this connection, we commend the effort reflected in Section IV.A. of the South Atlantic DEIS to enumerate the various forms of continuing supervision which remain available. However, that discussion is presented in the context of mitigating measures available to minimize or offset adverse environmental impacts. We respectfully submit that this formidable body of continuing Federal involvement is deserving of separate and more prominent treatment which will emphasize the fact that the lease sale is not the last and irretrievable step that totally divests the government of its control over the tracts involved. The subject is an integral part of the institutional structure for leasing rather than a true mitigating factor and, as such, would be more effectively presented immediately following the leasing proposal description in Section I of the DEIS. If presented in this fashion, the public and the press may be educated as to the true scope and effect of a decision to proceed with leasing. Perhaps more significantly, proponents of delay until every minute aspect of OCS environment is fully catalogued can be challenged to demonstrate how the lease sale can have the cataclysmic results they predict in the light of subsequent requirements which must be met.

Raised by: Columbia Gas System Service Corporation

Response: A sentence has been added to the brief summary discussion of the relationship of this proposed action to other governmental programs in Section I.E. calling attention to the more complete discussions included in Section IV.

Issue No. A-18: Proper review of the USGS OCS Operating Orders cannot be made until all Orders have been published in the Federal Register. (Draft OCS Orders 1, 2, 3, 4, 5, 7 and 12 appear in the Federal Register.) We, therefore, reserve comments on these Orders and this portion of the Draft EIS until all OCS Orders are available for review.

Raised by: State of South Carolina

Response: The above comment is a statement on a procedural question and does not appear to raise a specific issue. The draft orders which have been published relate to the conduct of OCS operations through the exploratory phase. Draft orders relating to development and production activities will be published at a later date.

Issue No. A-19: The latest state of the art technological capabilities and safety features based on the latest geologic knowledge should be required in all aspects of OCS exploration and development.

Raised by: State of South Carolina

Response: This is taken into consideration when the oil industry requests permits from the Geological Survey. Legislation pending in Congress to amend the OCS Lands Act of 1953 also addresses this issue.

Issue No. A-20: OCS leases should include special provision for oil spill liability and damage. Lessees should be strictly liable for all damages, including the total cost of control and removal of the spilled oil, and third party damages. Reference for patterning is made to the Trans-Alaskan Pipeline Authorization Act of 1973 (Title II of P.L. 93-253), or the Deepwater Port Act (P.L. 93-627) and S. 521, Outer Continental Shelf Management Act of 1975 (Section 23).

Raised by: Department of the Army, Corps of Engineers

Response: Proposed South Atlantic OCS Operating Order No. 7 described in Section IV and Appendix G, discusses measures to be taken in the event of an oil spill. Legislation pending in Congress to amend the OCS Lands Act of 1953 would establish such a fund.

Issue No. B-1: There was little emphasis on the adequacy of the current contingency plans for accommodating the increased activity. The adequacy of the Savannah area plan was never evaluated. The Coast Guard as well as the State makes regular patrols along the coastal area.

Raised by: State of Georgia

Response: The local Coast Guard Oil Spill Contingency Plans have been requested for inclusion in Section IV.B.3. Although the Coast Guard regularly patrols with the 12-mile limit, occasional overflights are made within 50 miles of shore. Section IV.B. covers the procedure followed by the various state, Federal, and private organizations in the event of an oil spill. The adequacy of OCS operators' contingency plan is decided by the Supervisor of the USGS Conservation Division. As to the adequacy of the Coast Guard and EPA Plan, questions should be addressed to those agencies.

Issue No. B-2: Adequate protection against oil spills should be provided in all leases and should be enforced effectively by the appropriate authorities such as the U.S. Coast Guard. In addition, adequate equipment and personnel should be available in the Southeast Atlantic to cope with the inevitable emergencies that would occur with any intensive OCS development.

Raised by: The Sierra Club, Joseph LeConte Chapter, Raleigh, N.C.

Response: The reviewer is referred to Section IV.B. This section outlines the oil spill contingency plans and responsibilities of the various Federal agencies. As outlined in OCS Operating Order No. 7 of the USGS, page 61, each operator must submit an oil spill contingency plan to the Supervisor before permits to conduct oil and gas operations are issued. As a result, Clean Atlantic Associates, a consortium of oil companies, has been formed to deal with oil spills. The consortium will (if the area is leased) contract with an operator to establish bases, stockpile oil spill equipment and make personnel available throughout the South Atlantic operating area.

If any oil spill were to occur or drift within the 12-mile contiguous zone, the U.S. Coast Guard will respond to cleanup the spill. The Coast Guard maintains the Atlantic Strike Force in Elizabeth City, North Carolina. They are aware of the proposed South Atlantic lease sale and constantly updating and adding to their equipment stockpile. The Gulf Strike Team based at Bay St. Louis, Mississippi, provides assistance to areas within the 12-mile contiguous zone offshore Florida, Georgia, and South Carolina. As explained in Section IV.B.1., the Coast Guard Captains of the Port at Miami, Jacksonville, Savannah, Charleston, and Wilmington respond to reported pollution incidents with contractor, oil spill cooperative and local Coast Guard equipment. National Strike Force equipment is used to supplement locally available equipment when required.

Issue No. B-3: Inadequate regulation and enforcement of offshore oil and gas technology could result in more accidents and more oil spills than would occur if a more effective system were implemented.

Raised by: The Sierra Club, Joseph LeConte Chapter, Raleigh, N.C.

Response: The Federal Government has many years experience in enforcement of oil spill regulations in the Gulf of Mexico. This experience will enable Federal enforcement agencies to continue and improve upon regulations in the South Atlantic area. OCS Operating Orders are being revised as appropriate to deal specifically with operating conditions in the South Atlantic (Section IV.A.1. and Appendix G). A recent report published by the Geological Survey in June 1977, and titled Policies, Practices, and Responsibilities for Safety and Environmental Protection in Oil and Gas Operation on the OCS, describes the wide range of Federal enforcement roles on the OCS, and improvements that have been introduced in recent years.

Issue No. B-4: There is no assurance that the technology utilized in the Baltimore Canyon Trough or in any other OCS frontier region would be adequate for oil spill surveillance, containment, and cleanup.

Raised by: Sierra Club, Joseph LeConte Chapter, Raleigh, N.C.

Response: This point has been covered in Section IV.B.4.

Issue No. B-5: There is no discussion of how much equipment and what enforcement there is for the oil spill contingency plan. An operating order should be included that requires the best available technology, and specific enforcement procedures. Which group, the Federal agency, or the lessee, has the responsibility of cleanup from a tanker spill beyond the 12-mile limit.

Raised by: Natural Resource Defense Council, Inc., New York, N.Y.

Response: This subject has been clarified by revisions to Section IV.B. The U.S. Coast Guard has primary responsibility for oil spill containment and cleanup within the 12-mile contiguous zone of the United States. The 200-mile limit does not apply to the National Contingency Plan. The adequacy of the oil spill contingency plan required by OCS Order 7 is determined by the Supervisor. OCS orders are promulgated independently by the USGS Conservation Division. It is the responsibility of the group who caused the oil spill to rush to the scene. The Coast Guard will assist the cleanup of any spill, if required, for the reimbursement cost. If no one claims responsibility then the courts will decide the blame and the cost.

Amendments to the Outer Continental Shelf Lands Act of 1953, now being considered by Congress, would clarify oil spill liability. Under the proposed law, whenever oil is discharged from an offshore facility or vessel transporting production on the OCS, the President shall establish agency spill cleanup responsibility unless he determines that removal will be done by the owner or operator of the facility or vessel properly and expeditiously. The legislation does not contain any limitation on the President's authority in this regard as to distance from shore.

Issue No. B-6: The status of oil spill containment and cleanup technology and the state of technology for containment on the open seas should be included.

Raised by: Ivan Teper

Response: Additional information has been incorporated into Section IV.B.4., oil spill cleanup technology is not well developed for heavy weather conditions.

Issue No. B-7: The discussion of OCS Order 7 should include the possibility of requiring pollution response equipment offshore on the platform to reduce response time in the event of an oil spill. This action would be consistent with the Coast Guard's Deepwater Port Regulations (33 CFR 149.319) and provide environmental benefits in light of the estimated 12-hour response time.

Raised by: Department of Transportation, Coast Guard

Response: The discussion of OCS Order 7 includes requirements set forth by the U.S. Geological Survey. Although requiring oil spill equipment to be placed on platforms would be consistent with Deepwater Port regulations, it is unclear to what extent exploration for oil and gas is considered similar to the operations carried out on DWP facilities. Industry operated oil spill equipment will be stationed at the major shore operating facility to ensure that equipment will be available as soon as possible. If field development were to occur in this area additional oil spill equipment may be required.

Issue No. B-8: Under Section B.1., paragraph 4 should be clarified to reflect that Coast Guard Captains of the Port located at Miami, Jacksonville, Savannah, Charleston, and Wilmington respond to all reported pollution incidents and if necessary, request assistance from the Gulf Strike Team of the Coast Guard based in Bay St. Louis, Mississippi. If necessary, the Coast Guard Strike Teams are capable of providing equipment and personnel resources. The Coast Guard Districts do not rely primarily on the National Strike Force for pollution

response equipment, but use primarily contractor oil spill cooperative and local Coast Guard equipment to respond to most spills. National Strike Force equipment is used to supplement locally available equipment when required.

Raised by: Department of Transportation, Coast Guard

Response: The FES has been corrected to reflect this comment.

Issue No. B-9: The installation of early warning devices such as an oil sensor or detector should be at fixed locations, this would enhance the overall reporting of spills. The liability and compensation of any oil spill incident is of great concern.

Raised by: State of South Carolina

Response: This comment is consistent with information outlined in Section IV.B.2. With respect to oil spill liability and compensation, see response to issue A-20, Section IV.

Issue No. B-10: The oil spill risk analysis should be used in the Oil Spill Contingency Plan.

Raised by: State of South Carolina

Response: Since the Bureau of Land Management has no jurisdiction in the area of oil spill cleanup, it is not likely that we could legally require the use of the DOI Oil Spill Risk Analysis by the U.S. Coast Guard. Section IV.B.3. covers a description of Clean Atlantic Associates.

Issue No. B-11: Institutional and technological factors affecting a cleanup operation should be discussed in full detail.

Raised by: Department of the Army

Response: We believe that Section IV.B. adequately covers the topic. However, this section has been updated to acknowledge the weaknesses inherent in spill cleanup operations.

Issue No. C-1: The State of Georgia requests that as more information becomes available, thereby allowing impact assessments, to be refined in greater detail, that supplemental EIS's be prepared. These documents should be distributed whenever significant new information comes to light, and previously published information becomes inaccurate or irrevelant. This should be done most importantly between exploration and development.

Raised by: State of Georgia

Response: Several comments have been received relating to the need for additional environmental and economic information as additional data are obtained as a result of sale-related exploratory and production activities. See responses to Issues D-2, Section I and A-5 and 6, Section IV.

Issue No. C-2: The statement that the Florida coast has almost continuous development from Jacksonville to Cape Canaveral is incorrect.

Raised by: State of Florida

Response: The reference to the Florida coast being "almost continuously developed from Jacksonville area south to Cape Canaveral" is referring to the nearshore coast line. The sentence has been changed to: "The Florida nearshore coast line has almost...".

Issue No. C-3: Page IV-14, paragraph 5. The sentence "The FWS, with assistance from appropriate State and Federal agencies, including NMFS..." should be rewritten to read, "The FWS, NMFS, EPA, and appropriate State agencies, now review...". Also, the last sentence "When appropriate, the agency recommends to the Corps..." should read "When appropriate, these agencies recommend to the Corps..."

Raised by: Department of Commerce

Response: The sentences have been changed to reflect this comment.

Issue No. C-4: P. IV-12: Under subsection 3, paragraph 1, the EIS states that the BLM is unaware of existing oil spill containment capabilities within the U.S. South Atlantic OCS area. Existing oil spill containment/cleanup cooperatives are located along the South Atlantic Coast at Charleston, Jacksonville, and Port Everglades. Although capabilities of these cooperatives are limited, they are available for OCS use. The discussion of current oil spill technology is highly optimistic in light of the present state of the art equipment and the recent Argo Merchant experience.

Raised by: Department of Transportation

Response: The text of the FES has been revised to incorporate this information. See Section IV.C.

Issue No. C-5: P. IV-14-16: In addition to EPA's SPCC plan, oil transfer terminals will normally be required to have a Coast Guard Operations Manual under 33 CFR 154.300.

Raised by: Department of Transportation

Response: This information has been added to the text.

Issue No. C-6: Generalities frequently appear throughout the section on mitigating measures dealing with the question of oil spill response in broad terms. Reference is made to existing or proposed oil spill containment capabilities in the South Atlantic OCS region, supported by an oil spill cooperative, Clean Atlantic Associates. However, all equipment referred to is presently located in Rhode Island under the Mid-Atlantic OCS region. A statement is made of plans to establish a similar base of operations for the South Atlantic region. South Atlantic OCS Order No. 7 calls for a detailed Oil Spill Contingency Plan separate and distinct from the EIS. However, to fully assess the possible impact resulting from discharged oil, it is necessary to review actual (not proposed) immediate response capability. Impact will certainly vary with the ability to contain and control discharge of oil. Comments are also made regarding equipment sufficient to handle one spill with back-up capacity for a second concurrent spill. The magnitude of these spills in relation to equipment capability is not addressed. It is suggested that further detailed elaboration be made regarding specific amounts/type of equipment, location, deployment, and overall response capability in regulation to varying degrees of spill magnitude.

Raised by: Department of Transportation

Response: There is no doubt that Clean Atlantic Associates will establish adequate oil spill equipment before drilling commences. This cooperative has been designed to satisfy OCS Order 7 and does in the Mid-Atlantic Region. However, prior to a decision whether or not to hold the proposed lease sale, there is no reason to stockpile oil spill equipment in this region. An equipment list has been included that is representative of equipment that will be provided by Halliburton in the event this sale is held. Testimony of O. J. Shirley at the Public Hearing in Savannah regarding this proposed sale is very specific. Also see response to Issues B-5 and 8, Section IV.

Issue No. C-7: Issues concerning pipeline placement and mitigating measures onshore were raised.

Raised by: State of South Carolina

Response: Existing responsibilities in regard to pipelines were discussed in Section IV.C.3.b. The jurisdiction of the Bureau of Land Management is limited to those portions of pipelines located on the Outer Continental Shelf. In the event the proposed lease sale is held and there is successful exploration, Secretary Andrus has stated that a development stage EIS will be prepared for the South Atlantic OCS area. In this case, data from exploratory drilling will permit more detailed examination of potential pipeline routes.

Issue No. D-1: Accidental or chronic spillage is the chief potential cause of impact. It is well-known that arbitrary regulations for oil spill prevention can reduce industry participation in the sale if they are insensitive to the economics of development and production. These facts frequently lead to controversy about the method of crude oil transportation, where divergent opinions are brought into direct conflict. The proposed stipulation quoted below seems to be a reasonable way of resolving the quandary: "If laying pipelines is environmentally and economically feasible, no crude production will be transported by surface vessel from offshore production sites to onshore facilities except in case of emergency. Determinations as to emergency conditions and the environmental and economic feasibility of pipeline laying will be made by the appropriate federal permitting agency."

Raised by: Applied Management Science

Response: A similar stipulation has been included in Section IV.D. of the final EIS as Stipulation No. 5.

Issue No. D-2: The "Notice of Support Activities" required by proposed Stipulation No. 4 should be sent to county governments and zoning board, county historical societies and commissions, city governments and zoning boards, city historical societies and commissions, and regional councils of governments as well as to the Governor of each directly affected state for comment to the lessee.

Raised by: State of South Carolina

Response: The mechanism and intent of the Office of Management and Budget Circular A-95 State, Metropolitan, and Regional Clearinghouses speak directly to this purpose. It would rest with the Governor to submit or not submit the proposed "Notice" to his States' A-95 clearinghouse.

Issue No. D-3: Several states commented on the cultural resource stipulation indicating unanimous preference for the alternative cultural resource stipulation appearing in Section VIII of the DEIS. Even though the alternative stipulation was preferred, additional provisions were requested in comments. Specific provisions desired to be included in the stipulation were as follows:

1. Require a broader consultation process in determining the invocation of the stipulation.
2. Incorporate the advice and interpretation of a professional marine survey archaeologist in performing and reporting on surveys required.
3. The stipulation is unclear whether all or just some of the tracts would require a survey.
4. The stipulation should include a listing of the minimum instrumentation and techniques required in a remote sensing survey.
5. There should be a provision for sharing information obtained with appropriate public agencies and the professional community.
6. Survey reports should require the reconstruction of submerged paleo-environments if possible.
7. Requested the provision for suspension of operations should a cultural resource be discovered during operations.

Raised by: State of South Carolina, Department of Archives and History State of Georgia

Response: Subsequent to issuance of the DEIS several meetings involving BLM, USGS, NPS and the South Atlantic States were held in order to determine whether a cultural resource stipulation could be drafted, which would be acceptable to all parties mentioned. A revised stipulation included in Section IV.D. satisfies many of the concerns expressed in the comments received on proposed Sale 43. Many of the issues such as a listing of techniques, instrumentation and survey format for archaeological surveys will be included in the Notice to Lessees and Operators. The position of the BLM is to recommend archaeological surveys on all tracts leased until an acceptable basis for projecting the probability of cultural resource occurrence on the South Atlantic has been determined. Likewise archaeological survey reports filed in this office will be available for inspection. Wording in the revised stipulation would require the operator to take no action without the Supervisor's approval. We believe a suspension of operations resulting from a cultural resource discovery would be extreme unless it is immediately endangered. Furthermore suspensions, when damage is not predictable, would tend to discourage disclosure of resources incidently discovered in the course of operations. Refer to the letters from the Secretary of the Interior to the Governors of South Carolina and Georgia (see Section IX.6.) which includes responses concerning the cultural resource stipulation.

Issue No. D-4: The State of Georgia would like to participate in lease stipulation development and have the opportunity to review and comment as appropriate.

Raised by: State of Georgia

Response: It has been the practice of the New Orleans OCS Office and the Washington Office of the Department of the Interior to seek full participation on the part of state governments in areas of concern to them, especially in the development of lease stipulations for this sale. See Section IX.A.4 for a listing of coordination meetings with Federal and State agencies and other groups pertaining to lease stipulations for proposed sale No. 43.

Issue No. D-5: Lease stipulations, operating orders, and notices should be finalized prior to the lease sale, and methods of ensuring compliance should be explained.

Raised by: State of Georgia

Response: The U.S. Geological Survey ensures lessee compliance with stipulations, operating orders, and notices, as discussed in Section IV. Stipulations should be finalized prior to the proposed sale, if authorized, and will be included as part of the lease document. USGS Operating Orders pertaining to operations involving exploratory activities should be finalized before a decision is made as to holding the proposed lease sale. Operating Orders pertaining to development and production should be finalized before such activities are approved. It should be noted that such Orders are subject to revision from time to time and would apply to operations on existing leases.

Issue No. D-6: Recommended lease stipulation No. 4 "Notice of Support Activity for the Exploration Program" should go to all affected states regardless of the status of their Coastal Zone Management Programs.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y. State of Georgia, State of Florida, Florida Audubon Society

Response: The statement that this "Notice" would be provided to states with approved CZM programs on DES page IV-15 has been deleted in the FES. The "Notice" is meant to be sent to all states regardless of their Coastal Zone Management program development status.

Issue No. D-7: The exact and final lease stipulations should appear in the FES.

Raised by: State of Florida

Response: See response to Issue D-5 (Section IV). Also, refer to the Secretary of the Interior's letter to Governor of Florida (see Section II X.6.).

Issue No. D-8: A stipulation adopting a period of suspension between the exploration and development phases of OCS activity should be developed which would take six months, paralleling the CZM Federal consistency requirement.

Raised by: State of Florida, Department of Administration

Response: See responses to D-2 (Section I) and A-5 and A-6 (Section IV). Currently, a period of at least six months exists between exploratory and development activities on the OCS largely for logistic and permitting requirement reasons. Coastal Zone Management regulations are being developed and will establish procedures for review of development plans and other activities under permit.

Issue No. D-9: The stipulation proposed to protect valuable biotic assemblages in "live or hard bottom areas" is not adequate. In addition to the requirement for a bathymetric map, there should be a definite provision for the imposition of specific preventive measures.

Raised by: Environmental Protection Agency

Response: Operational restrictions within each tract must be considered on a site-specific basis once the bathymetric information required by the stipulation is obtained. The Regional Oil and Gas Supervisor of the U.S. Geological Survey has the authority to require such restrictions.

Issue No. D-10: A special stipulation should be incorporated which requires the best available technology and safest mode of transporting oil.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: Proposed Stipulation No. 5 addresses the subject of transportation of oil. The special stipulations are evaluated in Section VIII.D.6. and if implemented will require the best and safest modes of transportation within the limits of environmental, technical, and economic feasibility.

Issue No. D-11: The "Notice of Support Activities" required by proposed Stipulation No. 4 should be expanded to include certain details.

Raised by: State of Florida

Response: As a matter of general clarification, the difference between proposed OCS Operating Order No. 15 and the proposed Lease Stipulation No. 4 should be brought out. The proposed stipulation applies to information supplied to directly affected states on the operator's exploratory program; whereas, the proposed Operating Order applies to information supplied on the operator's development program. The misleading reference to a "Notice of Support Activities for the Exploration, Development or Production Program" on DES page IV-15 has been changed to reflect this. The wording in the "Notice" of proposed Stipulation No. 4 has been altered to include the detail suggested.

Issue No. D-12: In Section IV, Mitigating Measures in the Proposed Action, Proposed OCS Order No. 12 provides that certain data on the drilling operation will be available to the public, but other data withheld. It is not clear whether specific properties of the petroleum will be made available to better facilitate identification of spilled oil. Also, under Special Stipulations, Page IV-17, it is not clear whether the drilling companies are subject to legal action for property damage due to spilled oil incurred by coastal communities and their residents. This type of legal responsibility would be desirable.

Raised by: Department of Commerce

Response: The data to be withheld refers to certain privileged information excluded from public disclosure under the Freedom of Information Act and USGS orders and regulations. The specific properties of OCS oil are available to the public for comparison as to source of a spill. This is a difficult means of identification because the spectrum is so broad, especially tanker oil vs OCS oil. All states have laws under which coastal communities and their residents could be awarded damages for losses arising out of oil spills. However, liability of the defendant is usually based on negligence which may be difficult to prove. Legislation pending in Congress to amend the OCS Lands Act would, if enacted provide for absolute no-fault liability for damages arising out of pollution and would establish an oil spill compensation fund.

Issue No. D-13: We also strongly recommend that a special stipulation be developed to require the use of bird repelling techniques during appropriate oil spill situations, as discussed in Section VIII.D., Other Alternatives Within the Proposed Action.

Raised by: U.S. Fish and Wildlife Service

Response: A proposal to require the use of bird repelling techniques is discussed in Section VIII.D.5. At present this technique is not included as a stipulation. However, bird repelling techniques are generally utilized by oil spill cleanup contractors during appropriate situations. Under the National Oil and Hazardous Substances Pollution Contingency Plan, The Fish and Wildlife Service has the responsibility and the authority to require whatever mitigation measures are deemed appropriate during an oil spill.

Issue No. D-14: (1) What constitutes "privileged information" on anything other than oil and gas resources and locations data?

(2) Why should lessee notices to South Atlantic States Governors' Offices not also be subject to approval or disapproval by the Supervisor?

(3) Is 30 days sufficient time for the Governor's office to have a review and comment on the notice of support activity for the exploration program by the lessee?

(4) Do such comments bear any legal weight?

(5) Page IV-9, in explanation, states only that "the Supervisor, in acting on an exploration plan, will take into account the comments of the State."

Raised by: State of South Carolina

Response: The above issue raised 5 questions regarding the "Notice" that may be issued, some of a suggestive nature. The questions are answered in their respective order as follows:

(1). "Privileged information" is composed of nine matters specifically exempted from public disclosure under the Freedom of Information Act (5 U.S.C. 552). These privileged matters are as follows:

(1) specifically required by Executive order to be kept secret in the interest of the national defense or foreign policy;

(2) related solely to the internal personnel rules and practices of an agency;

(3) specifically exempted from disclosure by statute;

(4) trade secrets and commercial or financial information obtained from a person and privileged or confidential;

(5) inter-agency or intra-agency memorandums or letters which would not be available by law to a party other than an agency in litigation with the agency;

(6) personnel and medical files and similar files the disclosure of which would constitute a clearly unwarranted invasion of personal privacy.

(7) investigatory files compiled for law enforcement purposes except to the extent available by law to a party other than an agency.

(8) contained in or related to examination, operating, or condition reports prepared by, on behalf of, or for the use of an agency responsible for the regulation or supervision of financial institutions; or

(9) geological and geophysical information and data, including maps, concerning wells.

(2). This type of "Notice" is intended as a means by which a lessee submits for review and comment to the directly affected states a report of activities that will be needed for his exploration program. No approval or disapproval by the Supervisor is provided by at this point. It is for the state's information.

(3). We believe that 30 days should be sufficient.

(4). "Real legal weight" - No.

(5). The comments of the state will certainly be considered by the Supervisor, including any request for additional information from lessees, however final authority to approve a lessee's plan rests with the Supervisor. In connection with the above issue of state participation in Federal activities and development of the OCS. The Coastal Zone Management Act of 1972, as amended in 1976, (16 U.S.C. 1451, et seq.), especially Section 307 thereof, and the proposed regulations thereunder published in the Federal Register of September 28, 1976 (41 FR 42878), will apply to potential OCS lease operations.

Once a state's Coastal Zone Management Plan has been approved by the Secretary of Commerce under Section 306, a lessee's plan for the exploration or development of, or production from, the OCS which affects the state's coastal must be submitted, pursuant to Section 307 (c)(3)(b), to the affected state for concurrence as to consistency with its Coastal Zone Management Plan. The state will have six months to study the lessee's plan.

We also note that a procedure for supplying the states with impact information relative to development stage operations is established in proposed OCS Order No. 15. See 41 FR 46355 (Oct. 20, 1976). Under Order No. 15 the Supervisor may not approve the plan until 60 days have elapsed from the date the State received it. The grounds for a State's objection, and the means for resolution of controversies, is similar to that set out in the regulations. 30 C.F.R. Sec. 250.34(c). (Appendix H).

Issue No. D-15: The biological stipulation needs to provide specific measures to be taken to protect live bottom systems.

Raised by: Environmental Protection Agency, U. S. Fish and Wildlife Service, State of Georgia, Department of Commerce, Natural Resource Defense Council, Inc., New York, N.Y., U.S. Geological Survey, State of South Carolina

Response: The proposed biological stipulation No. 1 in Section IV.D. of the FES provides specific measures to protect live bottom areas in the proposed sale area.

Issue No. D-16: Information gathered under provisions of the lease stipulations needs to be incorporated into federally-funded or federally-performed baseline studies which continue throughout the exploration and development phases of operations, and the states need to receive in a timely manner information about the baseline data being gathered and to make comment about additional data needed.

Raised by: State of Georgia, Department of Natural Resources

Response: This information will be available for use in the studies referred to. Also, please refer to response C-10, Section I.

Issue No. D-17: In the discussion of Alternatives With in the Proposed Action, the DES includes: waiting for approved coastal zone management plans, a government exploratory drilling program, suspension between exploration and development, and increased information required in the "Notice of Support Activity for Development". These are all positions that NRDC has supported since 1974. The DES does not examine the benefits derived from these options to the natural resources, to the local communities, or to the nation as a whole. This section does not discuss the feasibility of separating exploration from development, a major proposal of groups concerned with reform of the OCS leasing program.

Raised by: Natural Resources Defense Council, Inc., New York. N.Y.

Response: The alternatives mentioned by NRDC are evaluated in Section VIII "Alternatives to the Proposed Action". Additional evaluation of these alternatives are presented in the Programmatic EIS prepared by BLM in 1975, also reference is made to "Energy Alternatives: A Comparative Analysis" (GPO). The socio-economic impacts of this proposal is discussed in Section III.E.1. and Appendix K of the FES. In the event the proposed lease sale is held and exploration is successful, Secretary Andrus has stated that a development stage EIS will be prepared for the South Atlantic OCS area.

Issue No. F-1: How will liability and responsibility for OCS related developments that cause damages such as those from oil spills be assigned?

Raised by: Sierra Club - Joseph LeConte Chapter, Raleigh, N.C.

Response: Practically all damage resulting from an OCS related oil spill will occur within a state and the laws of that state would apply. Most states have laws providing for the award of damages arising out of the liability of the responsible party, however, liability is usually based on the negligence, if any, of the party responsible for the happening. Negligence is often hard to prove. Legislation to amend the OCS Lands Act is pending in Congress. This legislation would establish an oil spill compensation fund that would assure compensation for damages and losses from OCS related oil spills, regardless of the origin or cause of the OCS spills.

Issue No. F-2: All leases should include a provision which permits the Secretary to terminate the lease (1) if long term environmental damage is threatened or (2) if a biologically sensitive area is identified after the lease sale.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: The Department has taken the position that, under existing law the Secretary has no authority to cancel an OCS oil and gas lease on the basis of unforeseen environmental hazards. The Secretary does however, have the authority to suspend operations on a lease for this reason in order to determine whether the hazard can be overcome, e.g. by application of different technology, or whether Congress desires to condemn the lease. The Secretary has promulgated a regulation (30 CFR 250.12), which deals with this subject. Legislation pending in Congress to amend the OCS Lands Act contains provisions authorizing the Secretary to cancel leases in the event he determines that there is a potential inacceptable environmental hazard involved in lease operations.

Issues Concerning: Adverse Environmental Impacts Which Cannot be Avoided Should the Proposal be Implemented

Issue No. E-1: P.V-3. Although not as well understood as nearshore spills, offshore spills impact wildlife, e.g., whales, fish, etc.

Raised by: Department of Transportation

Response: Section V.G. has been revised to incorporate this information.

Issue No. E-2: Page V-2 and 3, sections E.F. & G. This section recognizes some adverse environmental impacts to beaches and wetlands, to vegetation and wildlife. However, these impacts are a risk we take for this resource development and the impacts will not be too severe. We believe this will be especially true if the gas and oil lines are brought onshore at planned corridors.

Raised by: State of South Carolina

Response: Please refer to the Secretary of the Interior's letter to the Governor of South Carolina (see Section IX.5.). BLM is currently developing a pipeline management program to reduce adverse environmental impacts.

Issue No. j-1: Measures should be considered to minimize secondary effects on onshore water quality resulting from runoff from new construction sites.

Raised by: Geological Survey

Response: To help mitigate the harmful side effects of pavement runoff geologists and hydrologists at the U.S. Department of Agriculture's Agricultural Research Service (ARS) in University Park, Pennsylvania, in coordination with the Soil Conservation Service (SCS), are currently engaged in a five year study on the effects of porous asphalt on hydrology.

Issue No. K-1: EPA has recently stated a policy of trade-off regarding HC emissions. This policy has significant potential as a mitigative measure and could prevent increased air emissions from becoming an unavoidable impact.

Raised by: Department of Transportation

Response: The Federal Register edition of December 21, 1976 (40 F.R. 55524-55530) announces EPA's policy for trade-off regarding HC emissions. This has been incorporated in the FES.

Issues Concerning: Relationship Between Short-term Uses of the Environment and Enhancement of Long-term Productivity

Issue No. A-1: More emphasis of the national need for OCS oil and gas development should be stressed.

Raised by: Federal Power Commission

Response: Additional information has been incorporated into the text.

Issue No. A-2: Though an emerging science, net energy analysis can offer excellent insights into the relative amounts of net energy available from various types or sources of energy. The BLM should analyze the potential net energy (simply stated, this is the energy produced from a source after deducting the costs of finding, developing, and delivering that energy to the end user) from the South Atlantic Sale. Then this amount should be compared with that net energy that could be generated by other actions such as an extensive energy conservation program.

Raised by: The Sierra Club, Joseph LeConte Chapter, Raleigh, N.C.

Response: Although detailed potential net energy has not been determined for the proposed Sale 43, experience in the Gulf of Mexico indicates that successful OCS operations produce a large surplus of energy in a form in which it can be readily transported to the ultimate consumer. This point is further discussed in response Section VII, Issue No. F-l.

Issues Concerning: Irreversible and Irretrievable Commitment of Resources

Issue No. A-1: The EIS does not give any information about the nature and location of production facilities or their impact on the natural and social environment. This information will, of course, not be available until exploration activities have determined what reserves exist at what locations on the Outer Continental Shelf. Our concern is that decisions not be made at this time which will irretrievably commit natural or other resources, before information is available to determine what resources will be committed.

Raised by: State of Georgia

Response: Hypothetical locations for some production facilities have been included in the impact statement. Some natural resources will be consumed in order to carry forward the exploratory activity. The decision to commit additional resources will be based, in part, on the results of the exploratory activity. Further examination of each lease will take place prior to development (after exploration) and another environmental impact statement will be prepared.

Issue No. F-1: What is the commitment of other energy resources necessary to obtain oil and gas from the Outer Continental Shelf? What is the net energy balance?

Raised by: Environmental Protection Agency

Response: According to data published by the Department of Commerce, during the year 1972, Industry 1381 (Drilling Oil and Gas Wells) purchased fuels valued at $43.5 million. The offshore segment of this industry consumed $1.1 millions of distillate fuel oil. Industry 1311 (Crude

Petroleum and Natural Gas) used $66.5 millions worth of fuel. The offshore segment of this industry used $9.5 millions of fuels. The term "offshore" encompasses a larger area than the term OCS. Additional fuel valued at $2.3 millions was purchased by the offshore segment of industry 1389 (Oil and Gas Field Services, N.E.C.). These estimates do not include the fuel required to construct the required facilities. The exact net energy balance is thus not available but the transport of natural gas and petroleum products from the principal offshore, and OCS, producing areas to other sections of the nation implies that the balance is favorable.

Issues Concerning: Alternatives to the Proposed Action

Issue No. A-1: The discussion of decreasing the number of tracts is discarded on the grounds that less oil would be produced. This appears to be the overriding theme of the DES, that the oil is greater in importance than the biological resources. The problem with this theme is that no thorough analysis has been made which weighs the long-term value of productive biological resources with the value of oil production for a short-term period. Furthermore, the rationale for choosing oil production is that the Sale "could provide significant additions to the nation's domestic production, particularly for use in the South Atlantic Region". The DES contains no assurances that the oil from Sale 43 will be used in the South Atlantic. In fact, if the oil goes to the Mid-Atlantic or Gulf for refining, it is most likely that it will become part of a national distribution system, not projected for the Southeastern states. Furthermore, the BLM has never made an attempt to evaluate how this program fits into overall energy needs of the nation, or into a rational energy policy.

Raised by: Natural Resources Defense Council, Inc., New York, N.Y.

Response: Qualitative discussion of lessened risk to other resources was included in the discussions of the various tract substitution and deletion options presented in Section VIII.A.

As to oil production possibly providing significant additions to the supply available for use in the South Atlantic region, and the lack of any assurances that the oil from Sale 43 will be used in the South Atlantic, probably the most important single factor would be whether or not oil refinery is constructed in the region. An operating refinery, producing products in demand in the area, would probably serve as a destination point for crude petroleum that may be found as a result of proposed Sale 43. In the event that such a refinery was not in operation, crude oil would probably enter existing refineries, and the resulting products enter the existing product distribution system. Some portion of these products will meet requirements in the southeastern states.

Natural gas produced on the OCS would probably enter the national distribution network, and the portion that would be applicable to the southeastern states determined by system-wide priorities applicable during the productive years of the possible new fields.

The Administration's national energy policy, including the part to be played by potential OCS oil and gas production is included in The National Energy Plan, Executive Office of the President, Energy Policy and Planning (April 29, 1977) which is available at the U.S. Government Granting Office Washington, D.C. 20402 (Stock No. 040-000-00380-1). Further, Secretary Andrus has recently announced the current Departmental policy relative to potential OCS oil and gas leasing in Interior News Releases of May 17 and May 25, 1977. (See Appendix O).

Issue No. A-2: We question the biological basis for the assumption on VIII-1 which states: "It is noted that the endangered species involved are highly mobile and can avoid spills." What data supports this statement? All marine mammals are mobile, but just as terrestrial species, they are bound by habitat requirements, salinity, food sources, seabed contours and other factors, many of which are unknown. In the already heavily developed South Atlantic, one questions where marine mammals would go were they pushed from existing habitats by an oil spill, platform or onshore facility and attendant traffic. We question as shallow and misleading the assumption on III-68 that when habitat for one animal is destroyed, "it may be replaced by another community" thus the net change from a food chain viewpoint could be minimal in localized areas.

Raised by: Endangered Species Productions

Response: The Preliminary Report of the Argo Merchant Oil Spill, U.S. Department of Commerce, March, 1977, states that of "43 separate aerial sightings of cetaceans" . . . "No marine mammal was seen in obvious distress or in direct physical contact with oil pancakes or sheen".

It has been estimated that offshore structures would require approximately 124 to 250 acres and onshore facilities 110 to 270 acres of land use, this is a very small portion of the U.S. South Atlantic coastal area.

Except for large oil spills, only localized areas are impacted and they are repopulated. The Santa Barbara Oil Spill (1969) has not demonstrated long-term deleterious effects. The estimated 161,500 barrels of fuel oil and gasoline spilled into American coastal waters near Ocracoke Island, N.C., during WW II has indicated that regional wildlife survived with minimal difficulty (MIT Sea Grant 77-4).

Issue No. B-1: Section VIII, "Alternatives to the Proposed Action", gives incomplete consideration as to why this sale is needed now. In particular no significant consideration was given to the alternative of active energy conservation.

Raised by: The Sierra Club, Joseph LeConte Chapter, Raleigh, N.C.

Response: Reference was made to Energy Alternatives, A Comparative Analysis. Conservation aspects have been included in Chapter 13 of this publication.

The alternative itself is examined in the OCS Programmatic EIS, Proposed Increase in Oil and Gas Leasing on the Outer Continental Shelf, July 7, 1975, where such a question for the broad program as a whole is more properly treated. The present national policy provides multiple means to achieve energy policy objectives including efforts to achieve a greater measure of self-sufficiency by means of active energy Conservation and domestic petroleum production.

Aspects of the President's National Energy Plan that require new legislative authority are still pending in Congress. Issue No. B-2: If the sale is determined to be necessary at all, what are the justifications for holding it in 1977 instead of in later years? Would a delay better suit our long-term energy needs?

Raised by: The Sierra Club, Joseph LeConte Chapter, Raleigh, N.C.

Response: The process followed by the Department of the Interior in scheduling proposed Sale No. 43 is described in Section I.D. of the FES. A decision whether or not to hold the proposed lease sale, which is now tentatively scheduled for March, 1978 has not yet been made. In making that decision, the Secretary will have to determine (1) whether he believes after consideration of the potential environmental impacts of and alternatives to disposal, that the proposed sale is necessary at this time as part of the overall effort to determine where on the OCS there are favorable accumulations of oil and gas and (2) whether the proposed lease sale is a constructive effort at this time in the nation's efforts to achieve greater energy self-sufficiency.

Issue No. C-1: More emphasis of the national need for OCS oil and gas development should be stressed.

Raised by: Federal Power Commission

Response: Additional information has been added to the text.

Issue No. C-2: Energy conservation is only briefly mentioned in Section VIII. This is crucial to alienate present energy storages but should not be considered as long-term solutions.

Raised by: Federal Power Commission

Response: Energy conservation is further discussed in "Energy Alternatives: A Comprehensive Analysis" Government Printing Office Stock No. 041-011-00025-4 May, 1975, and the programmatic final environmental statement FES 75. Also, see response to Issue A-1 (Section VIII).

Issue No. C-3: Section VIII.C. should be expanded. Analysis of fuel replacements based only on Btu contents is insufficient. There should also be consideration of versatility and interchangeability of the various fossil fuels as direct energy sources and industrial feed stocks. Further, potential hazards to health and the environment should be considered.

Raised by: Environmental Protection Agency

Response: In this discussion of the effects of withdrawing the proposed sale, energy required from other sources to replace energy substances that may be found as a result of proposed Sale 43 were estimated and presented. In the short term, the most likely fuel replacements would be oil and natural gas from other foreign or domestic sources. In the long term, if modifications to household, commercial, and industrial installations were made, the substitution of other energy sources could be made. Discussion of environmental considerations has been included in the publication "Energy Alternatives - A Comparative Analysis". The entire subject of alternative energy sources has been evaluated in the OCS Programmatic Impact Statement, Proposed Increase in Oil and Gas Leasing on the Outer Continental Shelf, July 7, 1975.

Issue No. C-4: The alternative energy sources to the offshore oil and gas leasing program are not examined. The rationale is that the Programmatic EIS contained that information. First, NRDC believes that the Programmatic EIS was inadequate in its consideration of this subject. Second, the amount of energy demand, and domestic trends in energy production have varied since the Programmatic EIS was issued. It is essential that the accelerated oil and gas leasing program continuously update the information on energy reserves and trends, and that the BLM provide that information both to the Secretary of the Interior and to the public through the NEPA process. This has not been done in the Draft Statement on Sale 43.

Raised by: Natural Resources Defense Council

Response: Reference was made in Section VIII.C. to the Programmatic FES (July 7, 1975) with the recommendation that more detailed information could be obtained in "Energy Alternative: A Comparative Analysis". This study was prepared by the Science and Public Policy Program, University of Oklahoma. The study, conducted under Contract Number EQ4AC 34 with the Council on Environmental Quality, was funded by the Atomic Energy Commission (now a part of the Energy Research and Development Administration), Council on Environmental Quality, Department of the Interior, Bureau of Land Management, Environmental Protection Agency, Federal Energy Administration, and Federal Power Commission, which is available to the public.

Another reference is National Energy Outlook (1976), published by the Federal Energy Administration, which is available to the public.

Issue No. C-5: In order to cure the general incompetency of the DEIS further consideration should be given to the alternative of taking no action to lease the Outer Continental Shelf at the present, but to determine the amount and location of oil and gas first and then produce the plan to exploit such resources affording public comment on same.

Raised by: State of Florida

Response: Exploratory drilling prior to leasing has been treated in Section VIII.D.2. and 3. Also, see responses to issues D-2 (Section I) and A-5 and A-6 (Section IV).

Issue No. C-6: Section VIII.C. discusses the alternative of withdrawal of the proposed sale, and relies on the OCS Programmatic FES 75 (July 7, 1975) for a discussion and evaluation of energy actions and alternative sources which might be used as substitutes for the oil and gas which may result from the proposed leasing. This discussion and consideration of alternatives by reference to a document which was published in 1975 is inadequate for the South Atlantic marine environment.

Raised by: State of Florida

Response: Energy alternatives to the OCS oil and gas program were appropriately discussed in the Programmatic EIS. Btu equivalent of alternaive energy sources required to replace energy potentially producible by this proposed sale are presented in the FES.

Issue No. D-1: The discussion of alternatives to government exploratory drilling prior to leasing, inadequately explains its advantages in providing a specific means of determining what environmental impacts will occur from the project and what steps may be taken to mitigate them. Furthermore, ignored completely is the alternative of permitting private industries to explore for oil and gas prior to the leasing of any OCS tracts.

This could be done in a method currently used by the Department of the Interior in the mineral leasing of other Federally-owned land. Specifically, oil companies would be issued prospecting permits for specified areas of the Outer Continental Shelf. Should a permittee discover valuable deposits on one or more of the tracts for which he holds a prospecting permit, it would receive the right to be preferred, that is, it would be given first choice, if the decision to lease those tracts were made. Under this alternative, the Department of the Interior would know where and what amount oil and gas occur prior to making the decision to lease. The Department could then more precisely predict how and where the oil and gas would be produced and transported. It could also more realistically determine the environmental impacts of

these activities and how those impacts could best be mitigated. Another means of determining the amount of oil and gas present and then developing a separate plan for production subject to public review would be to simply grant the lease sale along with the right to production but require such production to be subject to the review and approval of the Department via an environmental impact statement with public comment. In other words, although production rights would be guaranteed, the Department could require that production be done per an approved plan in the least environmentally destructive manner.

Raised by: State of Florida, Department of Legal Affairs

Response: Section VIII.D.2. on the alternative of governmental exploratory drilling has been revised to further discuss the environmental impact of the alternative. Also see response to Issue D-2, Section I.

Issue No. E-1: The discussion of intermediate storage of oil prior to transport to refining centers in the Mid-Atlantic or Gulf of Mexico should be strengthened. Although the Draft EIS mentions the potential for offshore storage and tankers to the other areas, it fails to seriously consider this alternative or evaluate its potential impacts. The Draft also fails to fully consider onshore storage and subsequent transhipment to other refining centers by tanker. We feel that both alternatives are very possible and should be better evaluated.

Raised by: State of Georgia

Response: Several of the scenarios incorporated into the impact statement discuss the possibility of onshore storage of crude oil and shipment to other areas for refining. Additional scenarios incorporating other assumptions have been included in the final environmental impact statement. (See Section VIII.E.). Further, in the event the proposed lease sale is held and there is successful exploration, Secretary Andrus has stated that a development stage EIS will be prepared for the South Atlantic OCS area. The subject of storage referred to in this issue would be addressed in such EIS.

Issues Concerning: Consultation an Coordination with Others

Issue No. A-1: The National Weather Service was incorrectly listed as the National Weater Bureau in Section IX.

Raised by: Department of Commerce

Response: This correction has been incorporated into the FES.

Issue No. A-2: It is suggested that consultations with the Fish and Wildlife Service and the National Marine Fisheries Service be conducted in accordance with the proposed regulations (42 FR 4868-73, 26 Jan 77) Section 7 of the Endangered Species Act of 1973.

Raised by: U.S. Fish and Wildlife Service, Department of Transportation

Response: Consultations with FWS and NMFS have been held fairly frequently, however more emphasis is planned pertaining to endangered species and designated critical habitat areas.

Issue No. E-1: The revised Secretarial Order No. 2974 should appear in place of the original in Appendix E.

Raised by: U. S. Fish and Wildlife Service

Response: We agree, and this has been done.

Issue No. G-1: OCS Order No. 2, 2B(2), page 50 specifies that the surface casing be installed to a depth sufficient to protect fresh water formations. We would like to be assured that the tertiary carbonates will be protected.

Raised by: State of Georgia

Response: If tertiary carbonates contain fresh water than they will be protected by USGS casing requirements.

Issue No. G-2: Best available and safest technology must be required for all phases of leasing operations where necessary to protect public safety, health, and the environment. Equipment must be inspected and a rigorous program of enforcement must be developed and followed by the responsible Federal agencies.

Raised by: Natural Resource Defense Council, Inc., New York, N.Y.

Response: Appendix G covers this topic.

Issue No. I-1: Inadequate information exists in areas of the carcinogenicity of crude oil to marine organisms and the effect of oil contaminated seafood on human health.

Raised by: Ivan Teper, Atlanta, Ga.

Response: At this time scientific opinion on the carcinogenicity of crude oil and the human health effects of oil contaminated seafood is divided. However, there are several studies underway or proposed which will provide better information on this subject.

Issue No. L-1: The data available to predict the trajectory of an oil spill seems inadequate and conflicting.

Raised by: State of Georgia

Response: See Section II., Issue No. B-9.

Issue No. M-1: The analysis of oil spill probabilities does not specifically identify spills associated with "offshore oil terminals" in the text although one or two are expected, and terminals are included in Table A-5.1. Since SPM's are the most likely type of offshore oil terminals and unloading ports have historically had about one spill in every 17 vessel calls (with a significantly poorer record for loading facilities), they would represent a significant percentage of the expected oil spill incidents.

Raised by: Department of Transportation

Response: See Section III., Issue No. A-21.

Issue No. M-2: With regards to the oil spill trajectory, it appeared that the MIT model is the ultimate. I disagree in this regard. The most important part of the MIT model is the wind factor (3.5% of the surface wind speed). This wind factor approach is still not convincing and conclusive. More importantly, the MIT model approach doesn't take into considereation how the wind is obtained. In both operational mode or risk assessment procedures, we should determine first the quality of the wind forcings before the trajectory computations. Our results are strongly dependent on how good is our meteorology. An oil spill trajectory model is only as good as the wind data input, and to a lesser extent the atmospheric stability.

Raised by: Department of Commerce

Response: It is not our intent to suggest that the MIT model, or any other existing model, is the ultimate. Models are no more than approximations. As you have noted, these approximations are limited in many regards, most assuredly by our lack of knowledge of the marine environment and our inabilities to simulate with great precision the behavior and fate of oil in the marine environment. Efforts to increase our knowledge of the marine environment and our abilities to simulate oil spill trajectories are being pursued separately by our Department and in cooperation with other government agen-

cies. For example, the modeling developmental work being pursued by the National Weather Service under sponsorship of EPA, is expected to provide considerable improvements over the constant wind factor approach used in the present analysis.

Issue No. M-3: Appendix M should analyze the feasibility of special precautions such as basing necessary containment and removal equipment at most likely impact locations (northeast and southwest of lease area).

a. With reference to the specific capabilities of the model, how would the trajectory and model be affected by nearshore currents, tidal fluctuations and the compounded effects of currents and tides? Is such a data available? What is the role of nearshore wind patterns?

b. How reliable is this model? Can this model be utilized as the basis for reasonable decision making on areas to lease or withdraw?

c. Can the model be improved by making it self-evaluating and validating?

Raised by: Environmental Protection Agency

Response: It may be possible to extend the analysis to deal with potential locations of containment and cleanup equipment. The importance of achieving containment at the spill site, however, must be stressed. Containment at the shoreline or location of other potentially impacted resource may be ineffective. Our thought has been to postpone treatment of the containment issue in the numerical analysis until we have a more thorough understanding of (and ability to model) the behavior and fate of oil in the area.

a. Nearshore currents and tidal fluctuations are not included in the model. Nearshore currents would disperse oil over a large area while tidal fluctuations would effect the times of impact on a shoreline and possibly introduce a cyclic aspect to shoreline contaminants. For both components of the circulation, specific effects would vary with location (shoreline shape, bathymetry, tidal excursion, etc.) At the risk of overgeneralizing, one might view the effects of nearshore wind patterns to be similar. Dispersion of oil over an area (and volume) of the sea is not addressed by the model.

b. The reliability of the model has not been determined. To our knowledge there are not sufficient (independent) data in this region to enable formulation of a reliability test. The utility of the model output at the basis for reasonable leases/withdraw decision-making is a debatable matter. The model results seem as the best tools we can secure at this time for assessing potential environmental impact. The model may reveal information which would not otherwise be apparent. In such a case the model results may serve as supportive evidence to be presented to the decision maker. Models have deficiencies; they are inexact representations of real circumstances. Even if an oil spill were exact in its simulation of the environment and the behavior of oil the results would not address other aspects of the decision process.

Issue No. M-4: The data available to predict the trajectory of an oil spill seems inadequate and conflicting.

Raised by: State of Georgia

Response: See Section II, Issue No. B-9.

Issues Concerning: General Comments

Issue No. A-1: The planning area for Georgia is at times only one county deep. The impacts, both positive and negative, are not so localized. Therefore, on behalf of the counties in Southeast Georgia that are prime candidates for impacts, I require that the planning area in Georgia be expanded to include not only coastal but adjacent counties. These additional counties should be included: Wayne, Brantley, and Charlton.

Raised by: Southeast Georgia Area Planning and Development Commission

Response: This additional information has been provided directly to J. Waters of the Southeast Georgia Area Planning and Development Commission.

Issue No. A-2: The State of Georgia request that EIS's for each sale and supplemental EIS's during sale area development continually reassess cumulative regional impacts and update projections using present conditions as the uniform base for comparison.

Raised by: State of Georgia

Response: In the event the proposed lease sale is held and there is successful exploration, Secretary Andrus has stated in his letter of July 22, 1977, to Governor Busbee, that a development stage EIS will be prepared for the South Atlantic OCS area. Cumulative impacts would be addressed in such EIS.

Issue No. A-3: The impact statement has been terribly vague on matters of great importance to people of this region such as the amount of tanker traffic, the placement of pipelines, the exact location and number of oil refineries and ancillary facilities. This information, of course, depends in good part on knowing the amount of oil available in the sale. But for the public to realistically understand the environmental impact of this project, they must be furnished with much more exact information.

Raised by: Ben Hubby, Savannah, Georgia

Response: This furnishing of precise locations and exact quantities of facilities prior to a lease sale is not possible. Future developments tend to increase the precision with which forecasts can be made with confidence. Further regulatory actions pertaining to future developments have been discussed in Section IV. Several potential scenarios of development have been discussed in Sections III and VIII. Also, see responses to Issues D-2 (Section I) and A-5 and A-6 (Section IV).

Issue No. A-4: The amount of time available for the public to evaluate the draft EIS was way too short.

Raised by: Ben Hubby, Savannah, Georgia

Response: The schedule of events pertaining to proposed OCS Sale 43 has been discussed in Section I.B. and D. Requests for public comment were solicited by Federal Register notice in September, 1975. The proposed tract list was released in the Federal Register on April 27, 1976 (Appendix A). The preliminary DES was released for State review on September 8, 1976. The draft environmental statement was released on February 15, 1967. Public hearings were held on March 28 - April 1, 1967. Comments were received as late as May 6, 1967. After the final environmental statement is released there is a minimum of 30 days before the Secretary's decision on the proposed South Atlantic Lease Sale No. 43. We believe this schedule allows sufficient time for public comment and participation.

Issue No. A-5: The physical size of the DEIS is deceptive since its double column format makes the approximately 700 pages a massive document. In this regard, an executive summary treating major environmental issues would greatly facilitate review of the DEIS by decision makers who do not have the time available to read, let alone digest and evaluate, the entire document. The summary on the reverse of the DEIS title page is hardly adequate for such a review.

Raised by: Department of Transportation, Coast Guard

Response: The summary page is not intended as a general summary for an EIS, but is intended as a summary of the proposal, as entitled. To include an executive summary may be a useful suggestion; however, it would also add more bulk to the EIS and the reviewer may inadvertently neglect important points or cross-referenced data.

Issue No. A-6: An Executive summary of the DES Statement would be most helpful to provide a more succinct statement of the salient facts and findings. In the event this is not possible, each section contained within the narrative of the DES should be followed with a synoptic review and summary of those major points contained within the section.

Raised by: State of South Carolina

Response: The impacts estimated to be applicable to each resource are summarized in the Impact Section (Section III). In general, the format of the EIS follows the guidelines prepared by the Council on Environmental Quality for the preparation of environmental impact statement (Federal Register, August 1, 1973, Vol. 30, Number 147, Part II). The major points of potential impact on other resources or activities are discussed in Sections III, IV, V, VI, VII, and VIII. Additional specific information is included in the appendices. Also, see responses to Issue A-5 (General Comments).

Issue No. A-7: The inconsistent use of the unexplained letter "M", meaning 1000 for the most part in the DEIS, is misleading (viz. ppm). Also, the similar use of a wide variety of exponential factors (10^5, 10^6, etc.) digital forms and mathematical words (million, billion, trillion) is confusing and could lead to misunderstandings. It is suggested that up to three digit modifiers of the terms "millions", "billion" or "trillion", as appropriate, be used. Some tables use hectares, some acres, some both.

Raised by: State of South Carolina

Response: On December 23, 1975, the Metric Conversion Act (Public Law 94-168) established that the policy of the U.S. Government shall be to coordinate and plan increasing use of the metric system in the U.S. The New Orleans OCS Office has attempted to comply with this act as much as possible. We use many data sources in compiling information for EIS's, some data does not lend itself to metric conversion without confusion, therefore it was decided to leave some units in their original format. We believe the use of abbreviate forms of nomenclature is acceptable to conserve time and costs.

Issue No. A-8: Service from scientists in the field should be sought.

Raised by: Marine Mammal Commission

Response: Several marine mammal scientists have been contacted such as Dr. D. Odell, Dr. H. Cambell and Mr. B. Irvine. Issues Concerning: Visuals, Vol. 2

Issue No. A-1: Cape Lookout National Seashore includes all of Shackleford Bank.

Raised by: National Park Service

Response: This information will be added to our environmental profiles. The next printing of visuals will incorporate this correction.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

FEB 18 1977

Manager, New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building, Suite 841
500 Camp Street
New Orleans, Louisiana 70130

Dear Sir:

This is in response to the Bureau of Land Management letter of February 11, 1977 inviting our comments on the Draft Environmental Statement concerning a proposed Outer Continental Shelf oil and gas lease sale offshore the South Atlantic States (OCS Sale #43).

We have reviewed the statement and determined that the proposed action has neither radiological health and safety impacts nor will it adversely affect any activities subject to regulation by the Nuclear Regulatory Commission. Accordingly, we have no comments or suggestions to offer.

Thank you for providing us with the opportunity to review this Draft Environmental Impact Statement.

Sincerely,

Voss A. Moore

Voss A. Moore, Assistant Director
for Environmental Projects
Division of Site Safety and
Environmental Analysis

cc: Director (732)
Bureau of Land Management
Washington, D. C. 20240

CEQ (5 copies)

OFFICE OF THE DIRECTOR

United States Department of the Interior

BUREAU OF MINES
WASHINGTON, DC 20241

March 7, 1977

Memorandum

To: Director, Bureau of Land Management

Through: Assistant Secretary--Energy and Minerals

From: Director, Bureau of Mines

Subject: Review of Draft Environmental Impact Statement for Proposed 1977 Outer Continental Shelf Oil and Gas Lease Sale, South Atlantic, OCS Sale No. 43

In response to your request of February 11, we have reviewed the subject Draft Environmental Impact Statement and have no comments concerning its content.

Director

RECEIVED
MAR 11 1977
ENVIRONMENTAL IMPACT STATEMENT

APPLIED MANAGEMENT SCIENCE

P. O. BOX 1066
SMYRNA, GEORGIA 30081
(404) 434-0662

March 10, 1977

RECEIVED
MAR 11 8 06 AM '77

Mr. John Rankin
Bureau of Land Management
New Orleans OCS Office
Hale Boggs Federal Building
Suite 841
500 Camp Street
New Orleans, Louisiana 70130

Dear Mr. Rankin:

I have reviewed the Draft Environmental Impact Statement for the South Atlantic Lease Area with great interest. Obviously, considerable effort has been expended in its preparation, with most of the topics receiving adequate investigation.

In the summary you observe that accidental or chronic spillage is the chief potential cause of impact, with which I whole heartedly agree. Additionally, it is well-known that arbitrary regulations for oil spill prevention can reduce industry participation in the sale if they are insensitive to the economics of development and production. These facts frequently lead to controversy about the method of crude oil transportation, where divergent opinions are brought into direct conflict. The proposed stipulation quoted below seems to be a reasonable way of resolving the quandry.

> "If laying pipelines is environmentally and economically feasible, no crude production will be transported by surface vessel from offshore production sites to onshore facilities except in case of emergency. Determinations as to emergency conditions and the environmental and economic feasibility of pipeline laying will be made by the appropriate federal permitting agency."

However, I must take exception to the statement made on page III-11:

> "At the present, there are no methods for computing the estimated volume of oil that might be spilled or released from tankers in this South Atlantic area alone. The only means presently available to calculate such a percentage for tankers from offshore platforms is on the basis of worldwide tanker spills versus volume of oil carried."

The enclosed paper describes a methodology to estimate spill risk which is responsive to the specific scenario. The spill risk evaluation takes into consideration such items as:

- Tanker size
- Ports traversed
- Unusual meteorlogical and seismic hazards
- Loading method
- Ultimate destination
- New regulations

In addition, the important question of intermediate storage is investigated. Page III-16 of the EIS contains the passage

> "It is a logical assumption however, that only onshore storage facilities will be used in the U.S. South Atlantic region."

This disagrees with the more plausible statement on page 19:

> "Whether or not oil pipelines are determined to be economically feasible, the dispersion of selected tracts seems to indicate that transportation scenarios should include some offshore storage in conjunction with tankering. Crude storage would probably initially be on surface with the later consideration of permanent subsea storage tank(s) awaiting the decision on a pipeline. Single-moored buoy loading facilities for tankers might also be expected."

The effect of offshore storage was apparently not considered in the EIS risk analysis.

As to the economic viability of OCS development, I will quote a section of page 10:

> "It should be pointed out that estimates of resource potential are inherently speculative and particularly so

in areas where geological information is limited and the presence of oil and gas has not been demonstrated. It should also be emphasized that the operational projections and estimates are highly speculative and represent a possible development scheme based on many variables and assumptions.

It will be noted that certain requests relating to employment impacts, locations of transportation facilities, and magnitudes of support related industry impacts were not addressed in the enclosed report. At this stage of planning, comments on these subjects were felt inappropriate."

And on page 17.

"Probably the most uncertain category are those items associated with transportation."

Even though the difficulties pointed out in these statements are quite real, it is still possible to glean useful information from the available data. Two steps will overcome many of the uncertainties raised

(1) Consider several hypothetical production sites in the lease area, with multiple transportation and storage scenarios for each site.

(2) Consider the entire range of reserves from 95% to 5% probabilities of occurrence.

The results of this type of analysis for one site in the Gulf of Alaska are illustrated in Figure 5 of the enclosed paper. As a companion to this chart, similar results are depicted in Figure 6 for the risk analysis.

While I will readily concede that the present cost and spill risk data base is imperfect, I do think the suggested methodology offers a logical way to combine the best available cost and spill risk information into a format that be used for rational decision making. Perhaps lending additional credibility to this hypothesis, it should be noted tbat a paper describing this methodology has been selected for publication in the Journal of Petroleum Technology.

If the enclosed paper arouses sufficient interest in the methodology, I would like to submit a proposal to conduct a similar study for the South Atlantic Lease Area, as the results should be enligbtening to all concerned and a valuable supplement to the EIS. Certainly you will agree that a well structured preliminary analysis now is more desirable than speculating about key issues until better data are available years after the sale. Thank you for your consideration of this letter, and please feel free to contact me at the above address if you need any additional information.

Sincerely,

John J. Owen III
President

JJO:jo
Enclosure

cc: Governor George Busbee
State of Georgia

Governor James B. Edwards
State of Soutb Carolina

Governor Reubin Askew
State of Florida

Governor James B. Hunt, Jr.
State of North Carolina

Mr. Hans Neuhaussr
Georgia Conservancy

FEDERAL POWER COMMISSION
WASHINGTON, D C 20426

MAR 11 1977

Manager, New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
Suite 841
500 Camp Street
New Orleans, Louisiana 70130

Dear Sir:

We appreciate the opportunity to comment on the draft environmental impact statement (DEIS) evaluating the proposed South Atlantic Outer Continental Shelf (OCS) Oil and Gas Lease Sale No. 43. The DEIS describes a total area of approximately 1,280,966 acres in 225 tracts located offshore of South Carolina, Georgia, and Florida. The estimated hydrocarbon reserves in the leese area consist of from 0.3 to 1.0 billion barrels of oil and from 1.9 to 6.8 trillion cubic feet of natural gas, offering considersble potential for future domestic energy production.

The Federal Power Commission's (FPC) Bureau of Natural Gas offers the following comments:

1) In view of the ongoing natursl gas supply shortages, several areas of the DEIS, in particular, Pages II-289, VI-I, and VIII-12, should more strongly emphasize the netional need for OCS oil and gas development. Severe industrial gas shortages in past weeks have caused widespread unemployment and cutbacks in the production of manufactured goods which should be discussed. Also, the increasing national dependence on foreign energy imports and/or future reliance on expensive synthetic fuels is clearly undesirable and should be given more attention when revising the DEIS. Finally, it has recently become apparent that energy conservation, which is given only brief mention on Page VIII-12, is crucial if we are to alleviate present energy shortages. However, conservation should not be relied on as the sole long-range energy solution which could obviate the need for OCS oil and gas.

2) On Page II-169, the DEIS states, "In the southeastern U.S. coastal region, the only major pipelinas are for natural gas." On the same page, a small table (untitled) lists 3,284 miles of petroleum products pipeline in the southeast states in 1971 and 3,687 miles in 1974. The table appesrs to contradict the first statement. It should also be noted that an application has been filed before the FPC in Docket No. GP74-192 to convert a major natural gas pipeline in the southeast to uae for petroleum products transportation. This pipeline, which is owned and operated by Florida Gas Transmission Company, is labeled as No. 27 in Figure G-1, Page II-170 of the DEIS. The FPC has not yet certificated the Florida Gas proposal; however, the initial decision by the administrative law judge for the case was in favor of the pipeline conversion project. Detailad information on the current status of the Florida Gas proposal is available from the FPC's Office of Public Information (talephone 202-275-4006).

3) The paragraph on Page IV-10 of the DEIS describing the Federal Power Commission's jurisdictional responsibilities contains several minor inaccuracies. The following is proposed as a substitute:

The Federal Power Commission (FPC) has responsibility under the Natural Gas Act to safeguard public convenience and necessity by the certification of proposed interstate natural gas facilities, regulation of interstate gas prices, and authorization of interstate gas purchases and sales. In evaluating a certificate application for proposed jurisdictional facilities, an environmental impact statement is prepared for all projects where FPC approval would constitute a major Federal action significantly affecting the quality of the human environment. All natural gas produced from the OCS is considered to be interstate; therefore, all OCS gas transportation facilities, excluding production and gathering facilities, are subject to FPC jurisdiction. In analyzing such offshore projects, the FPC consults with the Office of Pipeline Safety, the U.S. Coast Guard, the U.S. Army Corps of Engineers, and other Federal, state, and local authorities.

The Commission is directing its attention and efforts towerds reguletory ections to improve the criticel imbalance between neturel ges supply end demand. We recognize the importance of e responsible epproech, allowing the development of eddition el energy supplies with provision for effective environmentel sefeguards. Besed upon a review of your DEIS, we believe thet the proposed OCS oil and ges leese sele would be in the netional interest.

S. William Yost, Chief
Bureeu of Neturel Ges

THE UNIVERSITY OF NORTH CAROLINA
MARINE SCIENCES PROGRAM
CURRICULUM IN MARINE SCIENCES

12 5 VENABLE HALL
933 1262
933 1263

Chapel Hill North Carolina 27514

March 22, 1977

Mr. John L. Rankin, Manager
New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
500 Camp Street, Suite 841
New Orleans, Louisiana 70130

Dear Mr. Rankin:

I have reviewed the draft environmental impact statement prepared on Proposed Lease Sale No. 43 - South Atlantic Outer Continental Shelf. I appreciate your sending me the document and will attempt to summarize my comments in this letter.

My dominent impression is that the document lacks focus and therefore fails to provide an adequate assessment of the potential impact of South Atlantic OCS oil and gas development. One example of inadequate focus is represented by the DEIS treatment of live bottom areas off Onslow Bay, North Carolina. These areas are described in general terms in the Description of the Environment section (pgs. II-108); their commercially important finfish populations are described on pg. II-180; their recreationally important finfish populations on pg. II-201; and their resultant "biological sensitivity" on pages II 115-118. On page III-21, figure A-4 presents the probability of an oil spill in the tract area reaching Onslow Bay as 23%; yet nowhere is the potential impact of an oil spill on the live bottom areas of Onslow Bay, or anywhere else, assessed. Another example of inadequate focus involves the DEIS treatment of Calico scallops. The existence of Calico scallop beds in North Carolina is described on pg. II-108, the fishery is described on pg. II-189, the notion that the North Carolina populations are maintained by larvae transported from Florida is mentioned on pg. III-61, but no specific assessment of the potential impact of oil activities on the North Carolina scallop populations is included. There are other examples of descriptions without impact assessment involving shrimp nursery areas, impact of beached oil spills on recreational use of beaches, etc., but I hope my point is clear; the DEIS seldom focuses on a quantitative assessment of the impact of the proposed oil lease action.

An example of the focussed assessment approach that I think should be used throughout the DEIS is found on page III-16 where the data in Table A-6 is lucidly interpreted to assess the liklihood of oil spills caused by oil platform collapse. This treatment contains both data and <u>interpretation of the data</u>. Most of the DEIS contains either only the data; or, at best, the data supplemented with some unexplained estimates about the presumed

Mr. John L. Rankin
Page Two
March 22, 1977

qualitative nature of an environmental impact (see pages III 50-51 for an example of unexplained estimates of impacts on pelagic bird populations.)

My second major impression of the DEIS is that it contains an overly large amount of perifera1 information that only confuses the effort at impact assessment. For example, pg. II 119-120 contains a description of upland vegetation; Visuals 3N and 3S contain detailed maps of upland soil distributions; pg. II-137 reviews research from Long Island, Rhode Island, St. Andrews Bay, New Jersey, etc., but none in the lease sale area. I recognize that research in the sale area is limited, but I see little value in including information that is clearly not germane to the proposed action.

My third impression is that the DEIS contains a strong indictment of the Bureau of Land Management's planned environmental studies program for the South Atlantic OCS. In particular, pages I 8-9, if read in the areal context described on pg. I-1, makes clear that the "benchmark" data to be "collected prior to oil and gas production so that any environmental impacts can be detected by monitoring the same parameters during the production stage" (pg. I-6) are to be collected with an areal frequency ranging from 1 sample per 6,600,000 acres (rates of sediment mobility), through 1 sample per 1,725,000 acres (water column biological and chemical data), through 1 sample per 800,000 acres (macrobenthos including resident demersal fishes), to 1 sample per 414,000 acres (geological, chemical and biological analyses. For comparative purposes, the densest two of these sampling frequencies is equivalent to 1 and 2 samples within an area the size of the state of Rhode Island. I fail to see how a sampling frequency of this intensity can establish an "environmental benchmark" for anything, much less a benchmark of environmental conditions in an oceanic area dominated by intrusions of Gulf Stream water from one side and land runoff from the other.

I hope these comments will be of some use to you. I would be happy to expand upon them if you would like additional information.

Sincerely yours,

Dirk Frankenberg

DF/jt

CAPE FEAR COUNCIL OF GOVERNMENTS
POST OFFICE BOX 1491
SUITE 206 1 NORTH THIRD
WILMINGTON, N C 28401

Serving Local Government in the North Carolina Counties of Brunswick, Columbus, New Hanover and Pender

Telephone (919) 763-0191

March 22, 1977

Manager, New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
500 Camp Street, Suite 841
New Orleans, Louisiana 70130

Dear Sir:

RE: EIS #D29-77; U. S. Department of Interior, Bureau of Land Management; Draft: 1977 Outer Continental Shelf Oil & Gas Lease Sale

The Cape Fear Council of Governments has completed its review of the above referenced environmental impact statement. We find this statement to be in conformance with regional goals and objectives and not in conflict with regional plans or programs. No adverse environmental impact is anticipated.

This letter contains the official Regional Clearinghouse comments.

Sincerely,

Bevelry P. Paul
Executive Director

BPP/ceb
cc: Chrys Baggett, Clearinghouse Supervisor

South Carolina Department of Archives and History
1430 Senate Street
Columbia, S. C.

P. O. Box 11,669
Capitol Station 29211
803 — 758-5816

March 25, 1977

Mr. John L. Rankin, Manager
New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
500 Camp Street, Suite 841
New Orleans, Louisiana 70130

Dear Mr. Rankin:

These comments are given in response to your letter of February 14, 1977 asking for review and comment on the Proposed Lease Sale No. 43 - South Atlantic Outer Continental Shelf.

Our reply follows the spirit if not the letter of the federal procedures for the protection of historic properties (36 CFR 800), which require that the Federal Agency official in charge of a Federally funded or licensed project consult with the appropriate State Historic Preservation Officer. Our reply does not reliave the Federal agency official of deciding for himself whether or not the 36 CFR 800 procadures have been followed or of the final responsibility for reaching an opinion of his own as to whether or not historic values have been adequately taken into account (in allowing the project to proceed). The opinion of the State Historic Preservation Officer is not definitive, either by law or by established Federal procedure. In reaching a conclusion of his own, the Federal agency official may well wish to consult other experts.

We have several comments and recommendations to make about the Department of the Interior's Draft Environmental Impact Statement:

1. Referring to Page II-206, Section II, G. G. E. (4), the second column: we wish to encourage the carrying out of the detailed study along the South Atlantic OCS region to determine geologic trends, in order to make a more accurate estimation of the approximate extent of dry land during Paleo-Indian and later times. Until this can be done, we support the conclusion reached in this same column that "all tracts proposed for leasing...be considered capable of containing prehistoric living sites." We interpret this to mean that, given our current state of knowledge, the archeological potential of all tracts is equal.

2. Referring to Page III-119, Section III. E. 8, Impact on Onshore Cultural Resources, the second column: we feel that the final environmental statement should spell out which existing regulations will guarantee review of onshore development. We also feel that the possibility of onshore development where no

regulations apply and/or where no federal funding or licensing is involved should be addressed.

3. Impact on Onshore Cultural Resources, page III-119: Contrary to III-120, the State Historic Preservation Office will not be called on to review plans for onshore and nearshore facilities for oil drilling operations on the outar continental shelf unless those facilities are Federally funded or licensed. We also emphasize that all comments by the State Historic Preservation Officer are advisory only, and that he is not responsible under either state or federal law for protecting cultural resources from environmental effects of the above facilities. Under Federal law, the Federal agency official funding or licensing such operations is responsible for seeing that the cultural environment is taken into account. Under Section 106 of the National Historic Preservation Act of 1966, as amended, and under NEPA, the responsibilities of the Federal agencies have been clearly written. See the Federal Register of February 10, 1966, or 36 CFR 800.4.

The Draft EIS and other information about this project shows that it will have impacts on onshore cultural sites. Even with detailed safeguards, the EIS shows there is at least a ten percent chance that any oil spill will affect cultural sites. These effects aren't just limited to pollution of archeological sites with oil, they also include effects on the physical and biological environment that surround and are a part of historic and archeological sites.

Any resulting onshore facilities will provide additional impacts, or possible impacts, such as unsightly or out-of-charactar structures near historic sites, the destruction of archeological sites, and secondary impacts connected with land development, economics, and population trends. The sites shown on the map of the South Atlantic Coast illustrate the density of historical and archeological sites near the South Carolina Coast. The map does not show nearly all the sites listed on tha Statewide Historic Sites Inventory and the Statewide Archeological Sites Inventory in the coastal areas.

Types of onshore facilities that are expected have been listed on page I-4 of the Draft EIS. These include pipelines, terminal-storage facilities, gas processing plants, tankers using local ports, onshore operations bases, etc. Any of these can effect cultural resources. There will also be such secondary facilities as commercial areas to serve the primary facilities, housing for oil company employees, changes in real estate values and taxation, and possible shifting of employment trends and industry. This environmental study should make provision for BLM to conduct further environmental studies addressed to all the above facilities and on others, whenever any oil lease in the outer continental shelf is transacted with any oil company.

Oil spills and pollution of the coastal waters could have a great secondary impact on culturel sites onshore. Perhaps a study of the Gulf Coast states would help in refining definition of these impacts. Pollution of fish and shellfish

would hurt the fishing and restaurant businesses associated with historical areas, and discourage fishermen and boating enthusiasts who make up a large part of the tourists who visit historic sites. More direct efforts could be pollution of the waters at a historic plantation listed on the National Register. Dead fish, decaying vegetation, and odors would hurt the atmosphere at these sites that makes them enjoyable places to visit, and lead to the decline of good maintenance of old houses and plantations by residents and historical groups. Any adverse effects on the natural environments in this area would therefore cause adverse effects on the cultural environment. If the Federal and State agencies responsible for pollution control and water quality do a good job of protecting the waters, marine life, marshlands, and beaches, then historical and archeological sites in this matrix should also be protected.

The special stipulations on page IV-16 through IV-18, or similar stipulations, are necessary in order to evaluate possible effects from specific leases and drilling operations. The requirement that the lessee shall submit a "Notice of Support Activities for the Exploration Program;, or a similar type of notice, is needed for the Federal, state, and local agencies to accommodate onshore development. Municipal and county agencies, as well as the state, need the information in the "Notice" in order to plan for onshore development. Local agencies and groups that need notification include the following:

County governments and zoning boards
County historical societies and commissions
City governments and zoning boards
City historical societies and commissions
Regional councils of governments

4. Referring to Page VII-18-19, Section VIII. O. 6, Alternative Administrative Procedure to Protect Cultural Resources and "Live" Bottom Areas and Mitigate Potential Impact from Unexploded Munitions, Paragraph 2, "Cultural Resource Survey": we strongly prefer the alternative stipulation that is stated in this section to the stipulation proposed in Section IV. O. on Page IV-17. Our reasons for preferring the alternative in Section VIII. D. are as follows:

   a. The alternative provides a broader base for considering the necessity for survey beyond remote sensing. Whereas the stipulation in Section IV. O. places this responsibility solely in the hands of the Supervisor, who will apparently act only when he believes that cultural resources are present, the alternative includes the Bureau of Land Management in this decision. Considering the general lack of knowledge about underwater cultural resources, the opportunity should be available to conduct surveys even when evidence for the existence of such cultural resources is minimal.

   b. The alternative in Section VIII. D. provides that data from underwater preliminary surveys be reviewed and evaluated by a marine archeologist rather than by the supervisor alone. We feel that the marine archeologist should be involved in the decision-making process regarding recommendations for survey beyond remote sensing at an earlier stage than is provided for in the stipulation in Section IV. D.

In addition to preferring the alternate stipulation provided in Section VIII. D., we would further suggest the following changes and additions to the alternate stipulation:

   a. The opening sentence of the stipulation concerning cultural resource survey allows either a remote sensing and/or another type survey. Does this wording make it clear that some type of survey will be required? At lease a remote sensing survey should be required on all leases, and this requirement should be made clear in the stipulation to confirm the intent originally stated in Section III, C.M., Page III-63.

   b. In regard to the remote sensing survey, we feel that a minimum listing of techniques to be used should be incorporated in the stipulation. These should include at least magnetometer, sidescan and shallow seismic testing, with consultation required between the technicians who gathered the data and the marine archeologist reviewing it. We feel that the stipulation should further provide for consultation with marine archeologist prior to remote sensing survey in order to obtain their recommendations as to how the various techniques employed should be carried out.

Finally, we feel that tha stipulation should include a provision for protecting and maintaining all original remote sensing records.

   c. In regard to the results of remote sensing and other surveys related to cultural resources, we suggest that the stipulation include a provision for the publication and dissemination of these results to the professional community and to appropriate public agencies. Provision should also be made that the date not be available to tha general public until appropriate protection measures have been taken.

The survey reports should also include, insofar as possible, the reconstruction of submerged paleo-environments, rather than a mere reporting of the presence or absence of sites or objects. This would be valuable to the marine archeologist in increasing his capability to predict the locations of cultural resources, and thus to refine sampling strategies for future surveys.

As a matter of information, the comments provided in this letter were formulated in consultation with the Office of the State Archeologist, Institute of Archeology and Anthropology, University of South Carolina. We both feel that the Department of the Interior, Bureau of Land Management has certainly produced a thorough and commendable Environmental Impact Statement. We congratulate you.

Sincerely,

Charles E. Lee
State Historic Preservation Officer

CEL:vd
CC: Dr. Robert L. Stephenson
Institute of Archeology and Anthropology
University of South Carolina

Ms. Kathy Hendrix
Waccamaw Regional COG

Ms. Cindy Cole
Lowcountry Regional COG

Mr. Elias Bull
Berkeley-Charleston-Dorchester Regional COG

MID-EAST

SCH # 77-029

DATE 3-25-77

Attention: Mr. John L. Rankin

Applicant: United States Department of the Interior

Project Description: Dreft EIS Proposed Outer Continental Shelf Oil and Gas Lease Sale, South Atlantic, OCS Sale No. 43

We have received the "Notification to Clearinghouse of Intent to Apply for Assistance" for the above project and a review has been completed. The basis of our review of the submitted information is to determine the project's compatability with Regional goals and objectives. Therefore, the following determination is assigned to the project:

(X) the Areawide Clearinghouse finds the project to be in keeping with Regional goals and objectives.

( ) the Areawide Clearinghouse, prior to final Clearinghouse action, requests the project's official application for review.

( ) the Areawide Clearinghouse finds the project to be in conflict with Regional goals and objectives.

MID-EAST COMMISSION
137 Seaboard Building • Telephone (919) 946-8043
PO Box 1718 • Washington, North Carolina 27889

Page 2

The letter may be used as official Areawide comment to be attached to your application.

This letter signifies only approval from this responsible metropolitan and Areawide Clearinghouse. The U. S. Office of Management and Budget Circular A-95 requires that approval also be obtained from the responsible state planning and development Claaringhouse.

Sincerely,

Ross S. Persinger
Chairman

RSP/esp

CC: Mrs. Chrys Baggatt
Clearinghouse Supervisor

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BUR OF LAND MGMT.
OUTER CONTINENTAL
SHELF OFFICE
NEW ORLEANS, LA.

4 April 1977

Endangered Species Productions

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APR 7 9 36 AM '77
BUR OF LAND MGMT.
OUTER CONTINENTAL
SHELF OFFICE
NEW ORLEANS, LA.

Manager: BLM New Orleans OCS Office
Hale Boggs Federal Building
500 Camp Street, Suite 841
New Orleans, LA 70130

Dear Sir:

We are pleased to comment on the DEIS OCS Sale No. 43 (South Atlantic). In the interests of brevity and clarity, we will comment in three parts: 1) Cetaceans, 2) Manatees and 3) General.

Cetaceans

We question the listings in Table E-11. The beaked whales are listed as "stable." So little data exist on these species that this listing must be considered an assumption. This is also true for the pgymy and dwarf sperm whale species. We also question the assumption that the black right whale and humpback whales are "increasing." In this table, the sperm whale is noted at "above maximum sustanance levels." We assume this is a typographical error and should read "sustainable," in which case we must question it further, since optimum populations are now considered the basis for measurement of cetacean populations, not MSY (maximum sustainable yield). We would also question the assumption that Bryde's whale is "stable." Perhaps these should all read "no data." There are also two misspellings in the table: Bryde whale should be Bryde's whale, and Ziphus cavirostris should be Ziphius cavirostris.

On II-110. What is the data reference for the statement that catacean ranges seem to be delineated by Cape Hatteres and/or Cape Canaveral? Bottlenose dolphins and spotted dolphins do not have "commercial significance." Some bottlenose dolphins are taken by permit for public display and research, but this does not qualify as "commercial." Spotted dolphins are not collected in any numbers, cartainly not recently. The Federal Law is the Marine Mammals Protection Act, not Marine Mammal as writtan.

On II-113. The fin whale is on the US Endangered Species List. The IUCN may consider it "vulnerable;" the US Government considers it "endangered."

On III-49. We question if there is any wey to establish that oil spills would affect only individuals, not cetacean groups. What is the reference for the "limited data" which point to this? Even if any oil spill did touch only one individual, cetacean social systems are complex, and touching one would impact on the group.

On III-49. It is not established that fin, humpback and sperm whales are "increasing." What is the data base for this assumption?

On III-50. What is a "paucity" of cetaceans, and how is that established?

The material in this DEIS on cetaceans is incomplete and in some cases inaccurate. Additional input from catologists should be solicited before any lease sale is made. The authors of the DEIS seem unacquainted with on-going cetacean studies and published data.

ESP Endangered Species Productions, Inc.
175 West Main Street
Ayer, MA 01432 USA
(617) 772-0445

Phoebe Wray
Executive Director

Robert Wilds
Caribbean Coordinator
73 Myrtle Street
Boston, MA 02114

Rosemary Elkins
Southwest Coordinator
P.O. Box 2749
Tucson, AZ 85702

ESP- 2.

Manatees

The DEIS information on manatees is shallow. Many studies are presently in progress on this animal, yet the DEIS appears to be unaware of them.

On II-110. The DEIS states manatees "may" enter freshwater rivers. They certainly do so without question. There is information on manatees in the St. Johns and other rivers in Florida.

On II-113. We question that manatee migration routes are "long established," and the evidence that these animals "seek open waters." It is certainly not "definite" that manatees migrate offshore. Their migration routes are largely unknown. The status of manatees in peninsular Florida and elsewhere is not in "isolated pockets." The animals apparently live throughout the coastal waterways, appearing in and then leaving warm water refugia during cold snaps.

On III-50. Shipping traffic, as the DEIS states, would indeed impact on manatees. Boat traffic is already the largest factor in the decline of the species, and any additional pressure is very serious and should be avoided. Construction of shore facilities for off-shore stations would be harmful to manatees in the short- and long-term by increasing traffic, silting and destruction of aquatic plants which constitute the entire food of this large mammal.

To our knowledge, there is no evidence that manatees could or would "probably avoid any direct contact with an oil spill." On what is this assumption based?

On III-69. We do NOT agree with the statement: "In view of population distributions of the manatee the probability of their habitat locations having an increase in such (boat) traffic is slight." There is no clear idea of population distribution of these animals at the present time, so the assumption cannot be made that on-shore facilities and drilling and attendant increase in traffic would not hurt them. The Jacksonville area, which is a prospective site, is particularly sensitive for manatees.

On II-129. There is no evidence that the manatee range "has extended to South Caroline." There is no real evidence of manatee increases. The publication of increased numbers of manatees is very likely an artifact of an increased sighting effort.

General

We question the biological basis for the assumption on VIII-1 which states: "It is noted that the (endangered) species involved are highly mobile and can avoid spills." What data supports this statement? All marine mammals are mobile, but just as terrestrial species, they are bound by habitat requirements, salinity, food sources, sea-bed contours and other factors, many of which are unknown. In the already heavily developed South Atlantic, one questions where marine mammals would go were they pushed from existing habitats by an oil spill, platform or on-shore facility and attendant traffic.

We question as shallow and mis-leading the assumption on III-68 that when habitat for one animal is destroyed, "it may be replaced by another community; thus the net change from a food chain viewpoint could be minimal in localized areas."

In conclusion, we feel that any lease sale should be delayed until sufficient data on marine mammals in the South Atlantic are compiled. More studies may be needed. Existing data which has not been consulted should be seen and incorporated. Such data may also change other statements about the total South Atlantic system.

Sincerely,

Phoebe Wray
Executive Director

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

APR 4 1977

OFFICE OF THE ADMINISTRATOR

Mr. Curtis J. Berklund, Director
Bureau of Land Management
U.S. Department of the Interior
Washington, D.C. 20240

Dear Mr. Berklund

The Environmental Protection Agency (EPA) in accordance with its responsibilities under the National Environmental Policy Act and Section 309 of the Clean Air Act has reviewed the draft environmental impact statement (DEIS) on the Proposed 1977 Oil and Gas Lease Sale - Offshore South Atlantic (OCS #43). Specific detailed comments are enclosed.

In general we believe the introduction of petroleum development to the Southern Atlantic Outer Continental Shelf (OCS) area can be safely accomplished within the limits of appropriate environmental controls. However, we are concerned about the lack of adequate baseline data upon which to base realistic impact predictions and management decisions. Because unique and sensitive areas have not been sufficiently defined and mitigatory measures in some cases have not been clearly stipulated, we have rated this statement as Category ER - 2 - Environmental Reservations - Insufficient Information.

As you know, a large portion of EPA's involvement in the OCS oil and gas development program has focused on the scarcity of biological baseline data and inadequate integration of existing data. We believe area-specific environmental studies should be comprehensive, timely, and amenable to analysis in subsequent documents such as environmental impact statements. To date, these elements have been lacking, resulting in EIS's that still rely heavily on information derived from incomplete existing literature and fragmented, poorly related units of data. We request that the Bureau continue to devote effort to resolving problems of study scheduling and data utility. In addition, we suggest that a uniform data quality assurance program be incorporated in the environmental studies program to assist coordination between researchers in specific geographic locations, thereby fostering an interdisciplinary approach. EPA is also very concerned regarding the conduct of fate and effect studies to enhance our comprehension of pollutant pathways and mechanisms for uptake and utilization in marine ecosystems. We suggest that additional effort and resources be committed to assist the pursuit of this goal.

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ENVIRONMENT - STATEMENT

Another significant issue in impact assessment involves the composition and utilization of oil spill risk analyses. In the absence of better evaluative methods, EPA has expressed support for this analytical technique to determine optimal tract selections and transportation modes. However, we are fully aware of the present limitations of risk modeling and urge that probability and trajectory analyses be improved to a point of greater reliability in overall impact assessment. Such models would include both an accurate depiction of probable impact areas, and a realistic estimate of the effect on endemic natural resources.

With respect to onshore impacts, there is to an apparent lack of a methodology to predict induced development and subsequent secondary impacts on air and water quality from OCS developmental activities. For example, a method such as the GEMLUP (Growth Effects of Major Land Use Projects) is needed to estimate the land use and infrastructure impacts of such facilities.

Finally, we are concerned with the lack of specific measures to provide mitigation for the possibly adverse impacts of developing high hazard tracts. In particular, we believe there should be a binding lease stipulation to protect the resources of "live or hard bottom" areas. Such a stipulation should include measures such as prohibiting the emplacement of structions within a prescribed radius of a high value subsea feature, special disposal techniques for drilling muds, and establishing a monitoring system.

We appreciate the opportunity to review this impact statement and hope our comments will assist preparation of the final statement. Please let us know if we can be of further assistance.

Sincerely,

Rebecca W. Hanmer
Director
Office of Federal Activities
A-104

Enclosure

Environmental Protection Agency
Comments on
Outer Continental Shelf Oil and Gas Lease
Sale #43 (South Atlantic)

Specific Comments

1. Page II-27-28. With regard to alternative technology for development, we believe there should be further discussion on:
   a. measures to be taken in order to prevent major oil spills from pipelines and/or platforms due to earthquakes.
   b. measures to be taken in order to avoid possible platform collapse due to submerged karst topography.
   c. methods of trenching for pipeline burial in hard bottom areas.

2. Page II-54. In the Bumpus (1973) studies from 1960-70, ballasted bottles were used to decrease the influence of wind on drift trajectories. Is this condition representative of the behavior of crude oil on the ocean surface? What factor is most significant in oil movement and trajectory? Further, we suggest that due to the heavy dependence of this text on this study, it be included as an appendix to the EIS and appropriately referenced.

3. The discussion on trajectories in Appendix M (Figure 6) defines areas with the highest probability of being impacted by spilled oil. It should also analyze the feasibility of special precautions such as basing necessary containment and removal equipment at most likely impact locations (northeast and southwest of lease area).

a. With reference to the specific capabilities of the model, how would the trajectory and model be affected by nearshore currents, tidal fluctuations and the compounded effects of currents and tides? Is such a data available? What is the role of nearshore wind patterns?

b. How reliable is this model? Can this model be utilized as the basis for reasonable decisionmaking on areas to lease or withdraw?

c. Can the model be improved by making it self-evaluating and validating?

4. Page II-59. Since the coastal area under consideration has large areas of sandy beaches, data is needed on the seasonal changes in beach profiles. Should an oil spill reach shore, during what time of the year would natural beach construction or buildup processes most likely cause the oil to be buried?

5. Page II-59. What are the wave energy distribution and wave refraction patterns along the coast?

6. Page II-76. Oxygen concentration expressed in milliliters per liter is not useful since the temperature is not taken into consideration. Percent of saturation is a more meaningful expression.

7. Page II-77. No explanation is offered for a south to north increase of the heavy metal gradient.

8. Page II-91. Information should be presented on the effects of cyclones, tropical storms and hurricanes on offshore oil facilities

and transportation systems, since these phenonena are likely occurences in the lease area.

9. Page II-94. In general the biological data is inaufficient and has only been derived from existing literature. This data is extremely limited in its usefulnesa for establishing baseline conditions. There should be quantitative studies giving exact geographical location of communities and their seasonal composition.

10. Page II-156. An inventory of the transportation facilities of the area is given, however, the following questions should be answered considering both high and low production scenarios.
- What excess transportation and storage capacity does the area have, if any?
- What additional storage and transportation facilities are likely to be required by the area?
- What social, economic and environmental effects are likely to be produced by the use of available storage and transportation systems or what will be the impact of the needed additional facilities?
- Considering the shortage of oil pipelines in the area, what are probable ocean and land pipeline requirements and possible pipelines routes for the area?

11. Page II-80. Of the total fish landed in southeastern U.S. what portion was from commercial operations and from sports fishing?

12. Page III-25 - Table A-10. Since the biological baseline has not been determined for this area, assessment of the degree of recovery from an oil spill cannot be considered to be accurate. Further, there should be information regarding the effect of initial mortality on productivity at higher trophic levels.

13. Page III-34, 35. The factors that are likely to influence the location of onshore facilities should be ranked in order of importance. This would assist a more realistic projection and appraisal of probable facility sites and attendent environmental impacts.

14. Page III-48. Given a certain sediment grain size and knowledge of the currents in the area, how far could sediments travel and produce impact? Granulometric analyses should be performed.

15. Page III-48. What steps will be taken to avoid damage to benthic communities in "hard banks, live banks or fishing banks.?" Further, these terms should be more fully defined.

16. Page III-48. Studies are needed to provide bioassay data on effects of drilling muds on specific local benthic species.

17. Page III-48. The impact of oil operations on known spawning and fishing banks is poorly analyzed and lacks specificity.

18. Page III-59. What will be the short term and long term adverse effect on fisheries? What is the potential loss to fishermen and consumers?

19. Page IV-10. The statement regarding the inapplicability of EPA's National Pollutant Discharge Elimination System (NPDES) to waters of the contiguous zone and to floating craft or vessels is in error. These waters and these particular facilities are also included within our authorities for regulation of point sources of pollution and will be subject to EPA permitting requirements.

20. Page IV-16. The stipulation proposed to protect valuable biotic assemblages in "live or hard bottom areas" is not adequate. In addition to the requirement for a bathymetric map, there should be a definite provision for the imposition of specific preventive measures such as structure prohibition within a given radius of such a feature, special disposal techniques for drilling muds, and the institution of a monitoring system.

21. Page VII-2. What is the commitment of other energy resources necessary to obtain oil and gas from the Outer Continental Shelf? What is the net energy balance?

22. Page VIII-12, 13, 14. This section should be expanded. Analysis of fuel replacements based only on BTU contents is insufficient. There should also be consideration of versatility and interchangeability of the various fossil fuels as direct energy sources and industrial feed stocks. Further, potential hazards to health and the environment should be considered.

23. Figure VIII - 6, as referenced on Page VIII-9 is missing.

The following comments are addressed to Air Quality issues:

1. In the text of page II-91, the last paragraph of the first column seems to be in error. The second sentence should read: "Movement . . . generally from the southwest to northeast. . ."

2. Chapter II of the final statement should contain summary ambient air quality data consisting of annual averages and the highest two readings for each of the criteria pollutants where data are available. These data should be from each air quality sampling site in the coastal air quality control regions. Such data are necessary to evaluate the potential air quality impact of new large air pollution sources. The evaluation of potential new sources is complicated by a lack of coastal monitoring sites which measure total non-methane hydrocarbons and oxidants.

3. The statement on Page II-237 that, "In 1975 the total carbon monoxide reading for the Southeastern coastal Air Quality Control Regions (AQCR's) was 5, 924, 308 tons/yr" is incorrect. The correct figure is 1, 399, 752 tons/yr.

4. Table I-9 on Page II-249 does not reflect 1975 and 1976 data. Since this Draft EIS was written, there has been an updating of the 1972-1974 data. The Final EIS should reflect the updating of the earlier data plus inclusion of the latest available data.

5. Important corrections are necessary on Tables I-3 and I-4 (pages II-241-2). The top line of Table I-3 should read:

188	24, 492	28, 495	30, 020	41, 959	151, 815

The last line of Table I-4 should read:

Washington	1, 202	149	832	1825	7, 458

6. Figure A-5 on page III-24 should be modified to include transport and transformation in the area where atmospheric oxidation occurs.

7. The section in Chapter III considering the impact on offshore air quality on pages III-52 and 53 should provide typical emission estimates for various pollutants from fossil fuel equipment (e.g., electric generators) on the drilling platform.

8. The last paragraph on page III-53 concerning cumulative impact deserves further explanation and substantiation.

9. Several locations in the text indicate that the only pollutant for which violations of ambient air quality are occuring is particulate matter. This is not correct because EPA has designated the Jacksonville, Florida area as an Air Quality Maintenance Area (AQMA) with respect to both particulate and SO_2. This means that SO_2 violations are occuring or can reasonably be expected to occur in the future. AQMA's require a great deal more stringent siting criteria for locating large potential polluting sources such as petroleum refineries, shipping terminals, and bulk storage facilities. Any new refinery or storage facility will be required to meet EPA new source performance standards.

10. The final EIS should provide hydrocarbon emission estimates and rates for individual components and operation of petroleum transportation and storage facilities. This should include, but not be limited to, platform storage, valve leaks, tanker or barge venting, ballasting and purging, etc.

SOUTH GEORGIA AREA PLANNING & DEVELOPMENT COMMISSION

CHAIRMAN
J. A. CHAMBERS

EXECUTIVE DIRECTOR
ED GOODNIGHT

April 5, 1977

Mr. John Rankin
Director
New Orleans Outer Continental Shelf Office
Bureau of Land Management
U. S. Department of the Interior
Hale Boggs Federal Building
Suite 841
New Orleans, LA 70130

RECEIVED
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Dear John:

I have briefly reviewed the DEIS for the South Atlantic sale. My primary concern is that the planning area for Georgia is at times only one county deep. My personal experience in the Oil Refinery Study conducted by the State of Georgia convinced me that the impacts, both positive and negative, are not so localized. Therefore, on behalf of the counties in Southeast Georgia that are prime candidates for impacts, I request that the planning area in Georgia be expanded to include not only coastal but adjacent counties. These additional counties should be included: Wayne, Bramley, and Charlton.

Thank you for considering this request.

Yours truly,

Joe Waters
Assistant Executive Director

dm

cc: Ric Cobb, OPB
Jerry Bange

1908 NEWCASTLE AVENUE • P.O. BOX 1917 WAYCROSS, GEORGIA 31501 • 912-283-6037

My name is Ivan Teper; I am writing as a citizen concerned with our nation's energy needs and environmental problems. I hold a bachelor's degree in Geology and have studied Marine Ecology on the graduate level. I am presently studying environmental and energy conservation legislation and various impact statements.

The Draft Environmental Impact Statement, Proposed 1977 OCS Oil and Gas Lease Sale, South Atlantic Sale NO. 43, is both informative and interesting. I read the Conference/Workshop Proceedings, BLM Environmental Studies Program for the sale, to familiarize myself with the initial problems involved in the sale.

For your convenience my suggestions are summarized first, followed by comments on a variety of subjects covered by the Draft EIS.

The leasing of any OCS area is determined by whether or not such leasing and development would be environmentally, technically, and economically acceptable. We must remember that the OCS planning schedule does not represent a decision to lease in any area; the schedule represents the Department's intent to consider leasing in such area and to proceed with leasing and development of such area if it should be determined that leasing and development be acceptable. Let's remember that the BLM and USGS reviewed and ranked all seventeen OCS areas; the South Atlantic was ranked thirteenth among the seventeen areas in a composite ranking according to its resource potential

and preference. Also the Council on Environmental Quality placed the Southeast Georgia Embayment as the most hazardous of six generalized areas in the Atlantic. It is also important to understand that the Coastal Zone Management Act of 1972 provides grants-in-aid to states for the development and implementation of management programs to control land and water uses in the coastal zone, and that Federal action within the coastal zone must generally be consistant with the state's CZM program. But as of today no state adjacent to the proposed sale area has completed or received Secretary of Commerce approval for its CZM Plan.

Partly because of the above we must give a lot of consideration to Section VIII, "Alternatives to the Proposed Action," in the Draft Environmental Impact Statement. Section B, "Delay the Proposed Sale," would eliminate many problems. Not only would a delay postpone possible risks to the environment, but individual Coastal Zone Management Plans can be implimanted by each state, thus avoiding possible disputes between the state's regulations and proposed OCS development.

A review of the Conference/Workshop Proceeding, BLM Environmental Studies Program for the South Atlantic Sale, reveals some problems. In a discussion on October 14, 1975, Mr. Bruce Lent, Secretary of the Department of Administration, State of North Carolina, made this statement:

> There also seems to be a very definite need for more time in order to get what appears, from some of

> the comments from the speakers, to be the most basic of information to make good, sound, rational decisions. There also seems to be a very tight schedule that the Bureau of Land Management has in proceeding toward a leasing arrangement. It seems to me that we need a 3 to 5 year period or possibly a moratorium before going on with this program. If the Bureau of Land Management program for leasing continues as it is scheduled, North Carolina must seriously consider making a negative nomination for all of our lands off our shores. I am afraid that the Bureau of Land Management may have come to this meeting with preconceived notions and premade decisions. (page 126)

Dr. James Jones, Division of State Planning, Tallahassee, Florida, expressed similar concern:

> We in Florida have been concerned, as has North Carolina, about the speed with which development activities and studies and necessary sorts of things have occurred. (page 126)

Ellen Winchester, Chairperson National Energy Policy Committee, Sierra Club, San Francisco, California:

> Having expressed appreciation of the conference objectives, however, I must immediately question whether the Department of the Interior, as represented by BLM, is serious about obtaining additional information required for reasonable prediction and how, if it is, given the lead time required to obtain the information and the timing of the proposed lease sale a year from now, it plans to use the information to effect lease sale of drilling decisions. At a similar conference in California last February, the report of the biological oceanographic workshop concluded that the timeframe for a complete minimal study of one area would be 5 years. (page 80)

In order to substantiate the above statements, a review of the lease timetable is given.

May, 1975	BLM requested resource reports.
Sept, 12, 1975	A call for nominations and comments.
Oct. 14-17, 1975	Conference/Workshop, Environmental Studies Program.
Nov. 3, 1975	Negative nominations and comments due in.
April 27, 1976	Final 225 tracts were selected.
Feb. 14, 1977	The Draft EIS was released.
March 28-29, 1977	Public hearing in Savannah, Ga.
March 31, April 1, 1977	Public hearing in Charleston, S.C.
April 15, 1977	All comments on the sale due into BLM.
After April 15, 1977	A final EIS is submitted to the Council on Environmental Quality for a 30 day review, then the Secretary of the Interior is authorized to decide on the lease.

A close examination of the dates shows an initial 7 month period for data collection between May and November 1975, until the final 225 tracts were selected. At the BLM Environmental Studies Program, Conference/Workshop Proceedings held on October, just 3 weeks before all negative nominations and comments were due in, they were trying to formulate recommendations for baseline studies and monitoring which will help to adequately determine the environmental effects of any oil and gas exploration and development in the South Atlantic Outer Continental Shelf area. And they were trying to identify areas in which additional information is required for reasonable prediction and understanding for the environmental effects of drilling in this area. At this conference there seemed to be a lack of information and organized method to collect data, but all negative nominations were still due in. The BLM and USGS had 6 months to review the data and negative nominations and select the finial 225 tracts. Concerned citizens had only

2 months to review the Draft EIS.

In summation of the lease timetable, I feel there was not enough time for data collection and there was an obvious lack of time for review by scientists and citizens.

My finial conclusion after studying the data and Draft Environmental Impact Statement, is that the environmental problems are not fully understood and that there seems to be a lack in technical information, as well as vague questionable economic outcomes, therefore I support a DELAY IN THE PROPOSED SALE. The length of delay should be determined by the science community and a select citizen panel. After the delay, during which time more data is collected, a final environmental impact statement should be reviewed for at least 6 months. After the review, the EIS should be submitted to the Council on Environmental Quality.

We will also need to wait and see how the Carter Administration's energy policy and reorganization plans affects the OCS oil and gas lease.

The oil spill risk analysis model in the Draft EIS is based on spills originating from different regions within the lease area. But according to the figures on page III-12, Figure A-1, only 2.1% of oil pollution comes from offshore production. The oilspill frequency estimate reveals that we can expect at least only 1.5 oil spills of more than 1,000 bbl during production lifetime. A closer look at the figures reveals that 28.4% of oil pollution comes from tankers, 1.4% comes from tank barges and 17.3% from other vessels. We can expect at least 2.2 oil spills of more than 1,000 bbl from tankers during the lifetime of the lease.

Since a greater percent of oil pollution comes from tankers and we can expect a greater amount of large spills from tankers, Should'nt there be an oilspill trajectory simulation along-tanker routes? By neglecting analysis along tanker routes, we will fail to understand trajectory results, probabilities of oilspills reaching a particular geographic location, mean time to shore for spills, impact to biological resources and recreational areas , and other important results of a spill.

Therefore I support a delay in the proposed lease until more studies can be done on oilspills along tanker routes.

The Draft EIS does not fully cover the impact of short term population increases in areas which do not have sufficient services to deal with the increases. How will the communities deal with housing, water services, solid waste, schooling, and other problems.? Who will help pay to set up services? These problems are magnified because the population increases are gradual over time. Some type of study on the impact of short term population increases needs to be done.

Other areas inwhich information is inadequate is:

Geologic mapping in offshore areas. Page II-40

Bathymetric mapping for areas in the proposed sale. Page II-34

The direct carcinogenicity of crude oil and crude oil residues in marine organisms. Page 92, Appendix I

The effect of oil contamination of seafood on human health. Page 92

The oil spill containment capabilities within the U.S. South Atlantic OCS area. Page IV.-12

Status of oil spill containment and cleanup technology, and state of technology for containment on the open seas. Page IV-13

How would new oil affect the oil economy and energy conservation.

Is the South Atlantic lease timetable to fast?

Thank you for giving me this opportunity to comment.

Sincerely yours,

Ivan Teper
1253 Lenox Circle
Atlanta, Georgia 30306

Office of Planning and Budget

Executive Department

James T. McIntyre, Jr.
Director

GEORGIA STATE CLEARINGHOUSE MEMORANDUM

TO: Joho Raokin, Manager
New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
500 Camp Street, Suite 841
New Orleans, Louisiana 70130

FROM: Charles H. Badger, Administrator
Georgia State Clearinghouse
Office of Planning and Budget

DATE: April 14, 1977

SUBJECT: RESULTS OF STATE-LEVEL REVIEW

Applicant: Bureau of Land Management
U. S. Department of Interior

Project: Draft Environmental Impact Statement for Proposed Outer Continental Shelf Oil and Gas Lease Sale #43

State Clearinghouse Control Number: 77-02-15-10

I. Introduction

The State of Georgia has completed its review of the Draft EIS for proposed Lease Sale #43 and although we find it generally consistent with State policies and programs, we also find several deficiencies which should be corrected in the Final EIS.

In the following sections, we make specific reference to State policy regarding OCS oil and gas development, to actions which we feel would strengthen the overall programmatic approach to OCS development, and finally to actions which should be incorporated into the Final EIS and therefore, prior to the lease sale.

The Office of Planning and Budget is responsible for the coordination of the OCS and CZM programs within Georgia. In that role, OPB has prepared these comments addressing general policy and program administration questions. The Governor's testimony presented at the public hearing in Savannah, Georgia, March 28, 1977, elaborated on many of the comments contained herein and is attached for informational purposes.

270 Washington St., S. W. · Atlanta, Georgia 30334

The Georgia Department of Natural Resources has prepared detailed comments relating to potential aspects on the natural and cultural environments. These are also attached.

II. State Policy Regarding OCS Oil and Gas Development

The State of Georgia supports and encourages the development of the outer continental shelf. We firmly believe that with effective federal, State, local, and industry coordination, the program can be pursued in a mutually beneficial manner.

In particular, the State is concerned that the program be administered so as to be compatible with three fundamental objectives:

- the protection of natural and cultural resources
- the promotion of strong local and regional economies
- the preservation of the fiscal integrity of State and local governments.

Georgia welcomes this opportunity to make a positive contribution to domestic energy supplies. Although the highest projections for daily production from this area would constitute well under 1% of the national demand, we believe that every available source of energy should be identified and allocated for consumption as required.

III. National Policies Relative to OCS Oil and Gas Development

Georgia recognizes that the formulation of national policies is not solely within the jurisdiction of the Department of the Interior. Yet, there are two policies which we think should receive immediate attention.

First, the OCS oil and gas leasing program should be placed within the context of a comprehensive National Energy Policy which identifies available energy sources and prioritizes their consumption based on specific criteria. With the role of OCS oil and gas reserves properly delineated, their exploitation would then proceed in the most productive manner.

Second, the use of the OCS for oil and gas exploration, development and production should similarly be placed in the context of a National Oceans Use Policy. Our oceans are increasingly being used for a diversity of purposes, generally unrelated and almost totally uncontrolled. Commercial shipping, fishing, dumping, military exercises, recreation, communications and weather forecasting as well as mining for minerals and hydrocarbons are only a few of the current activities. In the future we will probably see deep water ports and terminals, power generation plants, and industrial siting expand in the nearshore areas. This proliferation of uses must be carefully examined and priorities established before we inadvertantly diminish the value of perhaps our greatest resource for the future.

The formulation of national policies relative to energy and the oceans must be a result of a dynamic partnership with all effected agencies and parties involved from the beginning. The states in particular, must be involved since their actions and attitudes will often be a critical factor in determining the eventual success or failure of prescribed policy.

Georgia is currently developing its Coastal Zone Management Plan, and is preparing a State Energy Conservation Plan. We are considering energy facilities siting legislation for pipelines, power plants, refineries, and tank farms. We are at the same time promoting industrial expansion in the State with many new industries being heavy users of energy. All these actions should be commensurate with federal actions and policy and the State certainly desires to make them so. At the same time, however, we cannot delay pursuing State policies and objectives when there is an absence of federal policy providing overall guidance.

IV. Comments on the OCS Oil and Gas Leasing Progra

This section will address general concerns with the OCS leasing progra which should be resolved as the various phases progress. We look forward to hearing DOI's reactions to these recommendations, and welcome any questions concerning them.

A. Supplemental EIS's

The State of Georgia has found the Draft EIS for this lease sale adequate in scope and content for proceeding with the sale except as otherwise noted. We recognize that prior to exploration the conjectural nature of the Draft cannot be avoided. Precise information is not now available to render more definitive impact evaluations. The State, therefore, requests that as more information becomes available, thereby allowing impact assessments to be refined in greater detail, that supplemental EIS's be prepared. These documents should be distributed whenever significant new information comes to light, and previously published information becomes inaccurate or irrelevant. This should be done most importantly between exploration and development. Since this request appears quite reasonable, the State has generally predicated its comments on this Draft assuming that such assessments will be forthcoming. Therefore, we would specifically request a response to this recommendation in the Final EIS for the lease sale so that we might adjust our comments should such supplemental EIS's be considered impractical or unnecessary by DOI. Many of the ensuing comments could be answered through the mechanism of supplemental EIS's and reference to them is made accordingly.

B. Regional Impacts

The use of individual EIS's to assess potential environmental impacts of lease sales and subsequent activities by sale area could preclude adequate consideration of cumulative impacts for the region. There are presently three lease sales scheduled for the South Atlantic. Undoubtedly, sales #54 and #56 will depend to a large degree on results obtained during the development of Sale Area #43. Yet, the Draft EIS only cursorily addressed potential impacts from the full development of the South Atlantic when the area could have potential reserves of over four times those being assessed at this time.

The State requests that EIS's for each sale and supplemental EIS's during sale area development continually reassess cumulative regional impacts and update projections using present conditions as the uniform base for comparison.

C. Socio-Economic Impacts

The State is particularly concerned with onshore socio-economic impacts resulting from offshore operations. In view of the tremendous uncertainty of such impacts prior to exploratory results, the Draft was necessarily vague in this regard. For informational purposes, however, the State used certain data contained in the Draft to modify the Georgia Econometric Forecasting Model developed at the University of Georgia. This model allows us to categorize various changes according to type of industry and to gain better insight into such key parameters as employment, personal income, and tax revenues. We have furnished BLM representatives with the results of this analysis in the hope that future socio-economic assessments for OCS development will be along the same level of detail. Such assessments would be especially suitable for inclusion in supplemental EIS's by amplifying data contained in the Notices of Support for Offshore Activity filed by the industry in conjuction with their exploration plans. Similar notice of support activity will probably be required prior to development and production as part of Operating Order 15 (not yet completed). We would think that the Secretary of the Interior, prior to approving exploration and development plans, would similarly like to be aware of regional socio-economic impacts forecasted by such an econometric model.

D. Environmental Studies Program

The Environmental Studies program now underway in the Bureau of Land Management has been extensively criticized by the scientific community. Not only has the program failed to incorporate nearshore and onshore ecological impact studies and fates and effects of spilled oil, it also has been scheduled so that findings are not available for pre-sale decision-making. We suggest that the program be restructured to include an adequate balance of studies of baseline conditions and fates and effects in offshore and onshore areas, and then rescheduled to provide data in a timely manner for use in pre-lease decision-making.

We recognize that such a redirecting of the program would probably delay the holding of Lease Sale #43. In order to avoid any unnecessary delays, we suggest that in the case of Lease Sale #43, the environmental studies be restructured so that useful information on the ecosystems as they now exist and on the fates and effects of petroleum in water be available prior to the review of industry development plans. A supplemental EIS addressing this issue would be highly appropriate.

In later sales such as #54 and #56, these environmental studies should begin well before the sale so as to enable the findings to be used in the preparation of pre-sale EIS's, and to serve as viable inputs into early decisions.

E. Dissemination of Information

Throughout the leasing, exploration, and production phases of OCS development, DOI should work closely with the states in providing them with any available information which is pertinent to their needs, and which is conveniently transferable.

V. Comments on the Draft EIS and Lease Sale #43

The following comments are specifically directed at deficiencies in the Draft EIS and at inadequacies in the decision-making process which culminates in the lease sale. The State of Georgia's endorsement of Lease Sale #43 must be contingent upon the satisfactory resolution of these concerns prior to the sale.

A. Lease Stipulations, Operating Orders, and Notices to Lessees and Operators

The lease stipulations and operating orders proposed in the Draft EIS were not only incomplete in scope but also for those that were proposed in Section IV-D, often inadequate in content. Specifically:

1) The proposed "live bottom" stipulation requires a survey for all leased tracts, but fails to require mitigation measures to protect any live bottom which is discovered. This stipulation should state that structures such as rigs and platforms will not be placed in any location which endangers a live bottom area. Measures should also be required to prevent discharge of drill muds or cuttings which might damage live bottom resources.

2) The proposed cultural survey stipulation applies only to those tracts which, in the Supervisory's opinion, contain cultural resources. This fails to ensure that appropriate technical personnel such as qualified marine archaeologists will be involved in the initial determination of where to require surveys and the evaluation of data gathered from the surveys which are required. This stipulation should contain a formal mechanism guaranteeing that the Supervisor's actions regarding cultural resources result from recommendations made by professional archaeologists.

3) The proposed barring of production stipulation should be amplified to cover other modes of transporting production. In particular, we would propose that transport by pipelines be addressed. Consistent with previous staff discussions with the Bureau of Land Management, we recommend that the following stipulation be appropriately included: "If laying of pipelines is environmentally and economically feasible, on crude production will be transported by surface vessel from offshore production sites to onshore facilities except in case of emergency."

With regard to the implementation of all stipulations, operating orders and notices, we call attention to Secretarial Order #2974 (revised, January 19, 1977). The State fully endorses the intent and purpose of this Secretarial Order to promote inter-bureau coordination. Section 4(h) of

the Order discusses the implementation of lease stipulations pertaining to cultural and biotic resources. The State would like to participate in the development of measures to implement these stipulations and to review and comment on specific aspects as appropriate.

On the matter of the proper time for issuing orders and notices, the State contends that these very important regulations will carry the full force of law only if they are in effect on the date of the lease sale. This contention is supported by DOI's Research Memorandum of October 31, 1975. The State of Georgia therefore, urges DOI to finalize all lease stipulations and operating orders and any notices required for their implementation prior to the lease sale. Specific attention should be directed at explaining the methods proposed for ensuring lessee compliance.

B. Oil Spill Contingency Planning

OCS oil and gas development and its associated transportation whether by tanker, barge or pipeline dramaticelly increases the probability of oil spills, leakages and discharges. The Draft expressed this increased risk quite well. Unfortunately, there was little emphasis on the adequacy of current contingency plans for accommodating the increased activity. In the case of Georgia, the U.S. Coast Guard's Captain of the Port in Savannah maintains the local oil spill contingency plan for all of Coastal Georgia. The adequacy of the Savannah area plan, however, was never evaluated nor was there any indication that such an assessment would be made in the future. The Draft also made the erroneous statement that there was no surveillance program currently along the coast. The Coast Guard as well as the State makes regular patrols along this vital area, and the Coast Guard intends to rebut that statement.

The Final EIS should make a more thorough evaluation of current contingency plans and should be used as the vehicle for initiating timely action to correct any daficiencies. Recently, a Coast Guard spokesman stated to the South Atlantic Regional OCS Advisory Board that over 90% of all oil spills were cleaned up on the beach. We find this situation, whether by design or circumstance, wholly intolerable and hope to see contingency plans revised as necessary to avoid it.

C. Transportation and Storage

In the light of USGS projections of marginal resources in Sale Area #43 we feel that the discussion of intermediate storage of oil prior to transport to refining centers in the Mid-Atlantic or Gulf of Mexico should be strengthened. Although the Draft EIS mentions the potential for offshore storage and tankers to the other areas, it fails to seriously consider this alternative or evaluate its potential impacts. The Draft also fails to fully consider onshore storage and subsequent transhipment to other refining centers by tanker. We feel that both alternatives are very possible and should be better evaluated.

D. Secretarial Decision on Holding the Lease Sale

The final decision as to whether or not to hold Lease Sale #43 rests with the Secretary of the Interior. Prior to making that decision, the Secretary is provided the Preliminary Decision Option Document (PDOD) which provides an executive digest of the important factors relevant to the sale. For the most part, this document forms the primary basis for a decision.

The State would like the opportunity to review the PDOD prior to its submission to the Secretary so that we may be aware of its content and orientation. We consider the OCS development program extremely important to the people of Georgia and wish to ensure that our interests and concerns are communicated to the Secretary in the most effective manner.

VI. Concluding Remarks

The State of Georgia sincerely appreciates this opportunity to comment on proposed oil and gas Lease Sale #43, and commends the Department of the Interior for its fine work in pursuing this important program. Any program of this magnitude necessarily requires considerable coordination and cooperation among numerous government agencies, private businesses, and interested groups and individuals, to develop the program in a mutually beneficial manner. The State of Georgia has enjoyed its working relationship with DOI, and is looking forward to an ever more productive partnership in the future as this program progresses.

CHB:jbp

Attachment (s)

Testimony of the State of Georgia on the Proposed South Atlantic OCS Oil and Gas Lease Sale No. 43

Presented by Norman L. Underwood

March 28, 1977

I am Norman L. Underwood, Executive Secretary to Governor George Busbee, and I appreciate this opportunity to present the views of the State of Georgia on the proposed South Atlantic OCS Oil and Gas Lease Sale #43. Governor Busbee had asked me to express his disappointment in being unable to personally present the State's position. Prior to the announcement of these hearings, the Governor acheduled an economic mission out of the country to promote business and travel exchange.

The Governor's Office of Planning and Budget has been designated by the Governor to be the central coordination point for all of our coastal development programs. Included as a part of those responsibilities are both the OCS Program and the Coastal Zone Management Program.

We feel that these programs certainly warrant the involvement of the Governor and by centralizing them in his Executive Office, he can maintain daily contact with the issues as they arise.

The comments which I will present today explain the position of the State of Georgia as it relates to the overall management of the Outer Continental Shelf Program. The more technical comments of the State will be submitted by representatives of the Georgia Department of Natural Resources.

Every year, the Governor of Georgia expresses his positions on the most important issues facing the State in his Policy Statement. This year's statement specifically included policies related to OCS development, coastal zone management, environmental quality, energy resources and economic development. Several copies of this policy statement are available for those desiring more information.

In general, I would summarize Georgia's policy relative to OCS development as being one of support and encouragement. We have consistently endorsed the program, provided it is administered in an orderly and coherent manner. Specifically, we welcome the furtherence of the OCS leasing program off our coast as long as the fiscal integrity of our State and local governments is not jeopardized, the viability of regional and local economies is maintained, and the natural and cultural resources of our coastal environment are protected. We feel that these concerns can be met in the context of an effective planning program which recognizes their importance and anticipates their needs. Such a planning program must necessarily be tied to the establishment of a comprehensive national energy policy with the role of national OCS oil and gas development being well defined within that policy. We recognize that this is beyond the scope of BLM, but nevertheless feel that it is vitally necessary.

Georgia has long been an advocate of the establishment of a strong national energy policy. Georgia shares with many of her neighbors a distinct handicap in regard to energy resources--we are almost totally dependent on coal, oil and natural gas produced outside our State.

We welcome this opportunity to participate in the production of energy resources and to make a positive contribution to the nation's domestic supplies. We feel however, that to maximize this potential contribution, OCS development off the coast of Georgia must be placed in the context of a national energy policy. Once that policy is formulated, we may find it more prudent to hold our OCS resources in reserve while we still have the option of importing foreign supplies. The use of strong conservation measures and alternative energy sources may forestall the need to totally deplete our limited domestic supplies.

Not only is OCS exploration and development taking place in the absence of a national energy policy, but each lease is considered in isolation rather than as a component of a regional program. Lease Sale #43 in the South Atlantic is only one of three sales off Georgia's coast now proposed to take place. Lease Sale #54 is proposed for December, 1978 and Sale #56 for September, 1979.

The cumulative impacts of production in all three areas will undoubtably go beyond the magnitude envisioned in this single impact statement. Some estimates of recoverable resources for the region run four times as high as those addressed in this draft. As development continues in other lease areas, we may find the need for refineries. We may find the need for many pipelines to shore and the expansion of inland interstate pipelines. We may even find that a deepwater storage terminal and tanker port are necessary.

The point is that under the existing approach to OCS development, there is no opportunity for Georgia to see the full potential or impact of producing oil and gas in the South Atlantic based on the limited information available at this time.

In simple terms, what we suggest is a Supplemental Environmental Impact Statement for each sale area after the results of exploration are known, but before development begins. Such a Supplemental EIS should assess the cumulative impacts of all OCS activity conducted to date in the South Atlantic, and update projections for future development.

I believe the Department of the Interior has made an admirable effort in trying to assess the potential impacts of OCS development in the South Atlantic. I also believe that this document, the Draft Environmental Impact Statement for Lease Sale #43, is basically adequate in presenting the limited information available for assessing potential impacts of OCS exploration. However, I think we can all agree that there are too many uncertainties still to be resolved for an Environmental Impact Statement at this time to to be the final decision-making tool for the full development of Lease Area #43. Lease sale, exploration and development are all distinct and separate phases of the OCS program which require different data and different decisions.

Further support for a supplemental EIS is best expressed by the final sentence in Section VII of this document.

> Except for the potential loss of: human life, investment, oil and gas resources, and archaeological resources; there are no other irreversible and irretrievable commitment of resources.

Other than human life, investment, natural and cultural resources, what other irreversible and irretrievable commitments could there be? Human life, investment, natural and cultural resources are surely the more fundamental values of our society. To take any action today which accepts these losses for the next 25 years would be unforgivable.

I think the Council on Environmental Quality has recognized this need for continual reassessments of important programs by expressing in their guidelines that:

> "An agency may at any time supplement or amend a draft or final environmental statement, particularly when substantial changes are made in the proposed action or significant new information becomes available concerning its environmental aspects."

In order for State and local officials to take any action which would allow them to effectively integrate their policies and plans with OCS development, they need realistic information. They need to have better estimates of recoverable resources and their location. They need to know projected production levels and methods of transport. They need to know the location of required support facilities, including processing plants, tank farms, pipeline landfalls, ports of call for tankers, and the frequency call. They need to know how many Georgians will be employed and how many families will move to the State. Will new schools, hospitals, sewer and water systems be required? How much economic activity will be generated and will it pay for these additional public service needs. They need to be aware of the contingency plans of the federal agencies and the industry in case of spills or leakages--where cleanup equipment will be located and how quickly it can be dispatched to the scene of a spill.

This type of precise information is what we have to have in order to undertake effective planning programs. I am sure everyone will agree that this Draft does not and could not provide that level of detail. Supplemental environmental statements, however, could readily answer these questions as sufficient information becomes available.

I was amused with the statement of Judge Weinstein in his recent court decision on the Baltimore Canyon sale:

> It is as if the Federal Government decided to proceed with the construction of a major highway connecting New York and Washington...but refused to reveal the contemplated route, whether bridges or tunnels would be utilized, whether mountains would be skirted or dynamited, or the impact on the area bordering the road.

An environmental impact statement between exploration and development will answer those questions before irretrievable and irreversible commitments are made.

Another major problem with the overall approach to OCS development is the lack of opportunity for states to protect their interests other than through legal action. Because State jurisdiction over the ocean is limited to three miles, resources controlled by this lease sale lie totally on federal lands. However, the impacts of these activities will not be confined to federal jurisdiction.

OCS development can be likened to a business venture--a joint venture between the federal government, the oil and gas industry, and the State and local governments. Like other business ventures, this one involves the elements of investment, profit and risk; all under the guiding principle that the profits will be greater than the investment. But, unlike other ventures, the risk in this venture is not distributed equitably in proportion to the investment and share of the profit.

Although we applaud the national objective of energy independence, we believe the risks to Georgia could outweigh the potential gains. At stake is the heart of Georgia's coastal environment and economy. The possible destruction or even damage to our beaches, our islands, our productive marshlands, or other valuable cultural and historic resources would be tragic. We ask for full participation as equal partners in order to protect our investment. We ask for our voice to be heard and our comments to be answered. We ask to be included in the decisions affecting our coast, to be advised and consulted.

Recent expressions of interest in State concern by the new administration are encouraging, and we look forward to a more productive relationship in the future. Within that context then, I would like to discuss three immediate areas of concern.

First, the Draft EIS for Sale #43 presented lease stipulations and operating orders proposed for the sale. As you know, these are the primary rules and regulations that govern the activities of the lesse. Several orders, lease stipulations and all notices are still in the process of being developed and may not be completed before the statement is finalized. Furthermore, current policies do not allow the states to participate in the development of or even comment on the notices to lessees and operators. We think it is to everyone's advantage, for federal, state and local governments as well as the general public and the industry to know all the rules before the game begins. Therefore, we request that the final set of lease stipulations and operating orders, as well as notices necessary to implement them, be included in the final EIS for public review and comment.

Second, we understand that the Secretary of the Interior makes his decision to go forward with a lease sale based on a "Preliminary Decision Option Document." Only a portion of that document is based on the EIS and the public comments made on the draft. The remainder contains priviledged information that neither the State nor the general public are allowed access to. If we are to have a meaningful partnership, we believe the State should be invited to review and comment on the document used by the Secretary to make his decision. I reiterate that the states are the ones who bear the major risks, not the federal government. Without knowledge of the content of this package the State cannot expect to be effective in safeguarding the interests of its citizens.

The final point which I would like to address is the Environmental Studies Program, which should be an integral part of OCS development planning. Most of us would assume that such studies are undertaken to gather data so that informed decisions can be made which anticipate adverse environmental impacts, and hopefully avoid them. The obvious intent of the Baseline Studies program as currently operated, however, is to establish a data bank which can be used after development occurs so that impacts can be evaluated as they occur; a post mortem examination.

Georgia would like to express its support for the several resolutions passed by the OCS Environmental Studies Advisory Committee (most notably the Jamison Resolution) which call for a thorough evaluation of the Environmental Studies program. While it may not be practical to complete

these studies prior to Lease Sale #43, they should be completed prior to development. This again reinforces the need for a supplemental environmental impact statement between exploration and development.

In conclusion, I would like to thank everyone for their patience in listening to my rather lengthy statement. We consider these to be extremely important issues. Governor Busbee would like to encourage everyone here to speak their views on this program. He is deeply interested in how you see it affecting your daily lives. Although I have to return to Atlanta shortly, members of my staff will remain here for the entire hearing.

By encouraging everyone's participation and by hearing each other's concerns, perhaps we can avoid in the South Atlantic the problems and setbacks which are plaguing other sale areas. Although we share many of the concerns raised in those areas, we feel this sale can proceed in an orderly fashion, commensurate with everyone's needs if we are all willing to work together.

The Governor's Office is vitally interested in this program and we want to be in touch with everyone affected by it--governments, industry, and citizens. Please keep us informed of your views and problems and we will certainly try to keep everyone aware of our positions and actions.

Thank you

Department of Natural Resources

Joe D. Tanner
COMMISSIONER

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April 13, 1977

MEMORANDUM

TO: Chuck Badger

FROM: Nolly Miller H.M.

ISSUE: DNR Comments: Draft EIS on OCS Lease Sale No. 43
(S.C.S. #77-02-15-10)

Departmental review of the above project is complete. This memorandum summarizes comments made by the reviewers, which fall into three general categories:

-acquisition and use of baseline data,
-methods of management under the proposed action, and
-lease stipulations.

The reviewers of this document had earlier reviewed the preliminary draft EIS for the project and had submitted both general and detailed comments to BLM. Various reviewers noted that their comments were incorporated in some sections of the draft EIS, but that some sections remained unchanged, apparently at the discretion of BLM staff writers responsible for those sections. Numerous minor technical and grammatical inaccuracies remain in the document, but our comments will not address them because they do not profoundly affect the conclusions of the draft EIS.

The reviewers are convinced that if baseline studies, exploration, and development of the petroleum reserves located on the South Atlantic Coast are carried out in an intelligent manner, commensurate with the state-of-the-art in these areas, we can have an environmentally acceptable extraction of these reserves. The following comments are offered to assist the federal government in achieving an environmentally acceptable extraction of OCS petroleum reserves.

Comment Area 1 -- Acquisition and Use of Baseline Data

The EIS under review concerns the leasing of tracts of land off the Southeast Atlantic Coast, but the proposed action will commit the federal government to certain other actions which may have significant environmental and social impacts, including exploration and development of petroleum reserves lying beneath the outer continental shelf. If a good strike is made,

there could be a continuing series of sales in the South Atlantic. This underscores the importance of acquiring good baseline data and monitoring indicator biotic species on a repetitive basis, to determine the nature of environmental impacts which result from these actions, and to use the information collected to regulate those actions intelligently.

Information currently available is generally adequate to evaluate the offshore impacts of the lease sale and of the relatively low level of activity anticipated during exploration. The impact of exploration on the principal artesian aquifer, however, cannot now be accurately assessed.

The draft does not indicate whether this is the only EIS proposed, or whether another will be prepared on the development phase when exploration is far advanced. Other activities will occur during development than simply those addressed in the EIS, and exploration activities should provide information essential in evaluating the actions and environmental impacts of development. If this EIS is intended as the only one, it has the following shortcomings:

--Available information is inadequate to determine the impacts of the development phase on many of the important coastal resources.

--Data are lacking in two important categories:
-location and quantity of petroleum reserves, and
-location and nature of many coastal natural and cultural resources, and the possible impacts of petroleum production on those resources.

Until adequate data are collected and evaluated, it would be premature to assess the impacts of development activities on coastal resources. For this reason, the reviewers recommended that a second EIS be prepared for the development phase of this project, incorporating data collected and evaluations performed during the exploration phase, which is expected to extend from 5 to 16 years after the lease sale. Most exploratory drilling is expected to be complete within the first five years.

The following is a list of specific concerns regarding the lack of certain data in the draft EIS:

--The EIS does not give any information about the nature and location of production facilities or their impact on the natural and social environment. This information will, of course, not be available until exploration activities have determined what reserves exist at what locations on the outer continental shelf. Our concern is that decisions not be made at this time which will irretrievably commit natural or other resources, before information is available to determine what resources will be committed.

--Continuing baseline studies need to be done in many areas, particularly those identified some months ago by a task force within DNR; a copy of this document is attached. The recommended studies should continue during the exploration phase of the proposed project, in order to generate adequate useful data for evaluating proposed development and production methods. Exploration in the areas of high industry interest, well beyond the three-mile limit, is not thought by DNR reviewers to be seriously harmful to birds, mammals, most fish and other marine resources. However, live bottom areas and other significant marine populations should be identified, mapped, and designated for protection prior to the initiation of exploratory drilling. Such populations should be protected from all destructive processes related to the installation of structures and the removal and transport of oil.

--Improper well construction techniques or trenching practices could cause contamination of freshwater aquifers that may extend under the Georgia continental shelf. These contaminants could include hydrocarbons, drilling fluids, and sea water. In order to evaluate the likelihood of contamination and to predict the direction and speed with which contaminants might move, data must be made available to the State from all exploratory drillings. In addition to the items mentioned in OCS Order No. 12, the Department of Natural Resources needs to receive, on a timely basis, for each hole drilled, a set of cuttings at 60-foot intervals from sea floor to total depth and a complete set of borehole geophysical logs. The Department possesses staff qualified to evaluate these data and develop predictive models for contamination of the principal artesian aquifer and other aquifers; moreover, the Department is charged with the responsibility of protecting groundwater quality in Georgia. For these reasons, we believe our request is reasonable. Information produced by early exploratory drilling needs to be used to plan subsequent drilling in order to minimize the danger of contaminating coastal Georgia's primary water supply.

The Department fully recognizes that the data derived from such wells are proprietary information of the companies performing the drilling. The Geologic and Water Resources Division, which would receive and analyze the data, is empowered to keep such information confidential, both by its enabling legislation and by the Georgia Oil and Gas Deep Drilling Act of 1975. The Division currently retains information of a confidential nature in secure files. The Department is willing to provide assurance that sensitive information will be kept confidential, to protect the substantial investments of the petroleum industry, and is willing to discuss these matters in detail with USGS at our mutual convenience.

When adequate data are available to locate the aquifer on the outer continental shelf and to develop a satisfactory predictive model, the Department will inform USGS that additional information is not needed. The USGS proposal to retain cuttings at a regional depository and to make them available two years after the lease sale will be satisfactory to the Department, once enough data to characterize and plan for the protection of the principal artesian aquifer andother important aquifers are available.

--The Department of Natural Resources needs to receive, on a timely basis, a copy of all bathymetric data which becomes available. We should have an opportunity to comment concerning the information to be mapped and the degree of accuracy with which mapping is done. The Department urges that each contractor doing sidescan sonar mapping be required to establish ground truth for all signatures, to verify the presence or absence of live bottom areas for various signatures. The Department, in conjunction with the State of South Carolina, has requested that BLM fund certain studies of live bottom areas, and the Department's concerns about these areas would be largely satisfied by the results of these studies.

--The U.S. Geological Survey has completed a hazard survey, showing numerous previously unverified live bottom areas. This information would have been useful in evaluating the draft EIS, but was not included. The Department would like to receive a copy of this survey, and any subsequent surveys.

--Available studies show that under certain conditions, petroleum fractions may be dispersed in the water column to a depth of 50 meters, which includes all Georgia's live bottoms. The EIS does not discuss this possibility, nor the effects of the proposed actions on the benthos, nekton, or crustacea onshore or on their user groups. This omission should be remedied.

--Data are available concerning certain impacts of petroleum exploitation on estuarine fishes, but they are not included in the draft EIS. The document should treat these impacts.

--There is an absence of basic information necessary to develop a responsible management strategy for dealing with cultural resources in the South Atlantic area of the Outer Continental Shelf. The Bureau of Land Management should immediately acquire a data base that will permit the development of predictive models for the investigation of shipwrecks and drowned prehistoric archaeological sites in the South Atlantic portion of the Outer Continental Shelf. These models will allow the definition of lease sale tracts within which there are significant probabilities for the existence of cultural resources. Because it is impractical, if not impossible, to survey the entire lease sale area in order to make a cultural resource assessment, the definition of sensitive areas by the use of predictive models is a reasonable and prudent strategy. However, the acquisition of the basic data necessary for the construction of such models is a prerequisite. The Draft Environmental Impact Statement at hand not only lacks the base data and, consequently, the predictive models that might be constructed from such data, but it also fails to provide for, or even call for, the acquisition of such data.

--The data available to predict the trajectory of an oil spill seem inadequate and conflicting, yet the reader does not receive enough information from the draft EIS to make an assessment. See especially:

- page II-54, 5th paragraph
- page III - 20, 5th paragraph
- Appendix L, p. 181, 1st and 3rd paragraphs
- Appendix M, page 186, 3rd paragraph

More research needs to be undertaken to resolve these uncertainties before the impacts of a potential oil spill can be accurately assessed.

--The entire section on birds (p. II-120 FF.) should be carefully reviewed by the Fish and Wildlife Service because only a portion of the available data bank was utilized and some rather shallow and crude interpretations occur.

--The draft EIS does not address inshore impacts of exploration activities. This is an especially serious omission, and should be remedied.

In summary, substantial data lacks, particularly those of a quantitative nature, will hopefully be corrected in appropriate baseline studies which will attend the exploratory phase. The Department desires to receive, on a timely basis, all data which are produced by these studies. Baseline studies should continue during the development phase, to provide additional information with which to regulate development activities. By continuing the studies, we should have a measure of the effects of petroleum exploitation when it is completed.

Concern Area II -- Methods of Management Under the Proposed Action

The Secretary of the Interior, in Secretarial Order No. 2974, sets forth guidelines for inter-bureau coordination in the OCS minerals program. This order generally establishes the responsibilities of BLM, USGS, and the U.S. Fish and Wildlife Service (FWS), and their relationships with one another. It authorizes each bureau to work with other agencies, as appropriate, in performing environmental research and monitoring, and in engaging in operational activities. The Department's concerns about research, monitoring, and enforcement of operational regulations fall into two general categories:

--Insufficient time appears to be allowed for making decisions which could significantly impact the States off whose shores OCS petroleum exploitation occurs.

--The order does not provide to States which could be significantly affected by DOI decisions, an opportunity to receive information concerning those decisions, or to comment concerning significant decisions.

The Department's comments on these concerns are as follows:

Insufficient decision time

--The appropriate USGS Area Oil and Gas Supervisor must consult with and receive recommendations from the appropriate FWS Regional Director and the appropriate OCS Area Manager for BLM under the following circumstances, among others:

-prior to approval of the design and plan of installation of platforms, fixed structures, artificial islands and pipelines,
-prior to approval of exploratory drilling plans, and
-prior to approval of plans of development.

FWS and BLM have five days to inform the USGS Area Supervisor of their intent to comment, and another twenty days to submit comments. Even assuming adequate baseline studies are complete, a twenty-five day review period may be inadequate to evaluate complex proposals such as those listed above. Since Departmental review notes many gaps in basic data, twenty-five days is far too short a time to deliver intelligent, informed recommendations concerning complex proposals. The Department should receive a formal opportunity to review and comment on all actions which could have significant environmental impact on Georgia; and twenty-five days would in some cases be inadequate for responsible review.

State comments on significant proposed actions

--Any proposed action which may have significant impact on the States off whose shores the actions occur should be reviewed by cognizant officials in those States, and their comments should be considered in making decisions. The States should be formally made part of a system of reviewing proposed exploration and production activities, and should be given a formal opportunity to comment on proposed actions which could have a significant impact on the States. (Specific State comments appear below.) Federal agencies affected by proposed actions, such as the National Park Service, should receive a similar opportunity.

--Georgia and the other concerned states should participate in determining protective measures and procedures for offshore, nearshore oil spills and for the location of nearshore facilities, particularly pipelines, as these approach State-owned lands and water bottoms. Under the authority of the Coastal Marshlands Protection Act of 1970, Ga. Laws 1970, p. 939, et seq. and as amended, the Coastal Marshlands Protection Committee and its staff of the Department of Natural Resources will analyze the effects of installations and pipelines in, on, and under the coastal marshlands and estuarine waters as these relate to the issuance of permits for support facilities, pipelines, refineries, and other related industries associated with the exploration and development of oil resources offshore.

--OCS Order No. 2, 28(2), page 50 specifies that the surface casing be installed to a depth sufficient to protect fresh water formations. We would like to be assured that the Tertiary carbonates will be protected.

--The manner in which pipelines are managed is still of major concern. Specific points include:

-No mention is made of pipeline maintenance until a significant spill is detected. Page III-9, 4th paragraph suggests that old pipelines need significant repair or replacement. This should be but was not addressed in EIS.
-The route surveys which are conducted by the BLM (and presumably the oil companies) do not seem to incorporate state concerns. The States should be involved early in the decision making process. See page III-19, 2nd paragraph and page 41 (States should be involved in step 1 of "Procedures").

-The safety valve described on page 25, Appendix C, 5th paragraph should be required. The remotely operated valve described on page 39, Appendix C, 7th paragraph should be required.

--Where predictive models for cultural resources indicate there will be a probable effect upon cultural resources resulting from oil and gas exploration and production, a methodology necessary to effect valid cultural resource assessment should be employed. Electronic remote sensing techniques are one such method. Other methods can and should be applied in conjunction with electronic sensing whenever and wherever they are appropriate. Such assessments should be supervised and evaluated by a professionally qualified marine archaeologist and should:

a) Identify all properties eligible for inclusion in the National Register which are within the area of the project's potential environmental impact.

b) Determine the effect the project may have on any such properties identified.

These evaluations should then serve as a basis for recommendations regarding the necessity for further compliance with mandates of the Historic Preservation Act of 1966 (P.L. 89-665), Executive Order 11593, and the Procedures for the Protection of Historic and Cultural Properties (36 CFR 800), promulgated by the President's Advisory Council on Historic Preservation.

--The following are technical comments concerning the Air Quality, Geology and Water Supply, and Water Quality sections of the referenced document.

-Air Quality

Comment: The air quality analysis should be upgraded to include professionally acceptable modeling or dispersion analysis consistent with the state-of-the-art to delineate the range of downwind concentrations of pollutants from the upset conditions discussed in the Statement.

-Geology and Water Supply

Section II: Description of Environment

Comment: Over the past ten years the U.S. Geological Survey has been monitoring selected wells in the Savannah area for chlorides. The results of this monitoring indicate no increase in the chloride content of the ground water of Savannah or Chatham County.

Unlike Savannah, where the chloride situation is stable, the chlorides in the principal artesian aquifer underlying Brunswick are increasing. The present thinking of U.S. Geological Survey is that the Brunswick chlorides are coming from an extremely deep, highly saline, aquifer; the upper chloride limit of which is unknown. The chlorides are leaking upward in an area south of Brunswick and are migrating north in a stairstep manner under the Brunswick peninsula. Since the upper chloride limit of the saline aquifer is unknown, we do not know how high the chloride concentrations in the principal artesian aquifer might go under present pumping conditions and especially under conditions of increased ground water withdrawal.

Improper well construction techniques or trenching practices could cause contamination of freshwater aquifers that may extend under the Georgia continental shelf. These contaminants could include hydrocarbons, drilling fluids, and sea water. The movements of potential contaminants in these aquifers need to be considered in the final EIS because a shoreward migration of one or more contaminants might cause an unacceptable degradation of ground water of Coastal Georgia. The EIS should include an analysis of the movement of water-borne materials within the aquifer.

-Water Quality

Comment: More detailed information should be given concerning the cleanup and containment capability in the South Atlantic region should a major oil spill occur.

Concern Area III -- Lease Stipulations

--All contracts and enforcement guideline language should be firm prior to the sale of exploratory leases, with the various states involved being allowed to participate in the construction and review of enforcement procedures and guidelines. The Department holds that a change in lease stipulations and enforcement guidelines following the involvement of the states constitutes a significant alteration in the proposed action and should require subsequent review and comment by the affected states.

Specific comments follow:

--Lease sale stipulation No. 1, dealing with cultural resources, indicates that decisions regarding cultural resources will be made without review and comment by a professionally qualified marine archaeologist. Geophysicists who lack full professional training and experience in marine archaeology are not qualified to make decisions bearing upon cultural resources. It is imperative that negative or positive actions, bearing upon cultural resources in the South Atlantic area of the Outer Continental Shelf, be a consequence of decisions that have resulted from the mandated and timely review and comment by professional marine archaeologists. This stipulation should apply to all leases, not just leases on areas where cultural resources are thought to exist.

--In general, cognizant state and federal technical specialists should have more involvement in decisions concerning baseline studies, exploration, development and production of the petroleum reserves located on the South Atlantic Coast, than the stipulations provide for. Technical specialists within BLM, FWS, and the National Park Service should perform the evaluation of impacts on biological and cultural resources and should decide whether specific lease stipulations should be rigorously enforced in specific cases. The Department should have a formal opportunity to comment on these evaluations and decisions.

--Information gathered under provisions of the lease stipulations needs to be incorporated into federally-funded or federally-performed baseline studies which continue throughout the exploration and development phases of operations, and the states need to receive in a timely manner information about the baseline data being gathered and to make comment about additional data needed.

--Enforcement of the stipulations may be a problem because of an inadequate number of USGS inspectors. The draft EIS should include a proposed inspection schedule, information on manpower requirements of the schedule, a summary of available inspection capabilities, and a plan to meet the need for an adequate supply of inspectors. This shortcoming needs to be addressed in the final EIS.

In summary, the Department believes the draft EIS is not fully adequate to evaluate the proposed action and the environmental impacts which could occur as a result. We believe that the document could require more effective measures to minimize environmental impacts, especially by improving proposed regulations, review techniques and management procedures. We have expressed our concerns and have recommended improvements to the document in an effort to ensure that state-of-the-art techniques will be used to achieve environmentally acceptable extraction of outer continental shelf petroleum reserves. It is our hope, therefore, that our concerns will be appropriately addressed in the final EIS.

Attachment.

State of Florida

DEPARTMENT OF NATURAL RESOURCES

HARMON W. SHIELDS
Executive Director

CROWN BUILDING, 202 BLOUNT STREET, TALLAHASSEE 32304

REUBIN O'D. ASKEW
Governor
BRUCE A. SMATHERS
Secretary of State
ROBERT L. SHEVIN
Attorney General
GERALD A. LEWIS
Comptroller
PHILIP E. ASHLER
Treasurer
DOYLE CONNER
Commissioner of Agriculture
RALPH D. TURLINGTON
Commissioner of Education

April 11, 1977

John Rankin, Manager
OCS Office - BLM
Hale Boggs Federal Building
Suite 841
500 Camp Street
New Orleans, Louisiana 70130

APR 15 9 25 AM '77

Dear Mr. Rankin:

Members of the Bureau of Coastal Zone Planning and the Bureau of Geology of the Division of Resource Management, Florida Department of Natural Resources, attended the recent public hearing in Savannah, Georgia on OCS Lease Sale #43. The Bureau of Coastal Zone Planning would like to provide additional input and suggestions for the record.

This Bureau supports the Department of Interior's offshore drilling program as a potential major source of new energy for the coming decade. We encourage the leasing of South Atlantic OCS Area #43 as scheduled and the subsequent exploration of the area by private enterprise. Following the exploration phase, however, several actions should be considered by the Department of Interior to promote greater coastal state involvement in the decision-making process regarding OCS development and production in the South Atlantic. The suggested measures are the following:

1. The requirement for a supplemental environmental impact statement after exploration detailing additional environmental and socio-economic data and information not available for the Lease Sale Environmental Impact Statement.

2. The requirement that exact specification of the final set of lease stipulations and notices be included in the Final Environmental Impact Statement on Sale #43 or in the supplemental EIS suggested in item #1.

3. The requirement for a larger state role in the review and decision-making process relative to the offshore development plans mandated by 30 CFR, Part 250.

DIVISIONS: ADMINISTRATIVE SERVICES • LAW ENFORCEMENT • MARINE RESOURCES
RECREATION AND PARKS • RESOURCE MANAGEMENT

4. The requirement of a Department of Interior and Department of Commerce agreement coordinating state review of offshore development plans and federal consistency as a part of coastal zone management. (This recommendation should provide for the integration of federal consistency defined under the Coastal Zone Management Act of 1972, as amended, into the Bureau of Land Management's development plan review process.)

5. Provisions that the "Notice of Support Activity for the Exploration, Development or Production Program" be forwarded to those states making adequate progress toward development of Coastal Zone Management Plans as well as to those states with approved coastal management plans.

In general, by providing for greater and more meaningful involvement by coastal states (particularly through their coastal zone management programs) in the OCS exploration and development process, other mitigating measures suggested in the Draft Environmental Impact Statement that encourage delays in offshore leasing and production could be precluded.

These comments and recommendations support the Bureau of Land Management's current leasing and development schedules and encourage little or no delays adversely affecting the oil industry. As Mr. Thomas Hart, Vice President of Shell Exploration, said at the public hearing, the oil industry can live with environmental stipulations but cannot accept delays much longer. Mr. Hart also indicated a willingness to talk with the states during the natural lag period between exploration and development. We believe our suggestions complement his statements by allowing open discussions between industry and the states early in the decision-making process, particularly during the industry's post-exploration lag period.

Finally, we would like to refute a statement made by Mr. Frank J. Kelley, representing the Assistant Secretary for Energy and Minerals, Department of Interior, Bureau of Land Management, on the public hearing panel. In response to comments from one of the speakers, Mr. Kelley failed to give adequate recognition to the planning and management functions inherent in any State CZM Plan. He maintained that coastal zone management is merely a tool for implementing local police powers. Comments of this nature illustrate the problems facing states in dealing with several federal agencies and expose the often unyielding position of federal government that can obstruct progressive suggestions from the states.

Mr. John Rankin
April 11, 1977
Page Three

Thank you for the opportunity to comment and provide recommendations on this program that is most crucial for fulfilling Florida's and the nation's energy needs. Please feel free to contact us if you wish to discuss this matter further.

Sincerely,

Bruce Johnson
Chief
Bureau of Coastal Zone Planning

BJ:ras

cc: Charles M. Sanders
Darryl Segraves
Ray Siute
C.W. Hendry

ADULT AND PEDIATRIC MEDICINE

BEN HUBBY M D
321 EAST HALL STREET
SAVANNAH GEORGIA 31401
TELEPHONE (912) 232-5511

April 12, 1977

RE: OCS Sale # 43

Bureau of Land Management
Department of Interior
Hale Boggs Building
New Orleans, La.

Dear Sirs,

In anticipation of the final impact statement which is being prepared on Sale # 43, I would like to submit this additional statement.

I do not believe that the Department of the Interior should proceed with the sale for the following reasons:

1. The impact statement has been terribly vague on matters of great important to the people of this region such as the amount of tanker traffic, the placement of pipelines, the exact location and number of oil refineries and ancillary facilities. This information, of course, depends in good part on knowing the amount of oil available in the sale. But for the public to realistically understand the environmental impact of this project, they must be furnished with much more exact information.

2. The amount of time available for the public to evaluate the draft EIS was way to short. There is no way that the lay public can really come to grips with a document of that size and in that format in the amount of time made available. I think it would be a grievous error to judge public reaction to the EIS based upon the hearings held only thirty days after its general circulation. I talked to citizens active in various areas- including shrimping- who were unaware of even the existence of the EIS. We cannot blame the Bureau of Land Management for the failures of the local media, but the bureau should not be misled by the imbalance of the participants at the hearings.

3. The HIS was contradictory in many major areas as I outlined in my statement at the hearings.

Sincerely,

Ben Hubby M.D.

DEPARTMENT OF HEALTH EDUCATION AND WELFARE
OFFICE OF THE SECRETARY
WASHINGTON D.C. 20201

APR 13 1977

Office of the Manager
New Orleans Outer Continental
Shalf Office
Bureau of Land Management
Hale Bogga Federal Building
Suite 841
500 Camp Street
New Orleans, Louisiana 70130

Gentlemen:

Encloseed are this Department's comments on the draft Environmental Impact Statemant for the 1977 Outer Continental Shalf Oil and Gas Lease Sale No. 43 - South Atlantic.

Thank you for the opportunity to review the document.

Sincerely,

Charles Custard
Director
Office of Environmental Affairs

Enclosures

UNITED STATES GOVERNMENT

Memorandum

TO: Charles Custard
Office of Environmental Affairs

DATE: April 1, 1977

FROM: Philip P. Sayre
Regional Environmental Officer

REG-756-3-77
Control # 835

SUBJECT: 1977 Outer Continental Shelf Oil and Gas Lease Sale, South Atlantic OCS Sale No. 43

We have reviewed the subject Draft Environmental Impact Statement. Based upon the data contained in the draft, it is our opinion that the proposed action cannot be evaluated within the scope of this Department's review.

The impact of facilities and growth induced as a result of the proposal and their effect on land, increase in population, infrastructure, etc. is dependent on several variables. Specificity would be required for a proper review of this Department's responsibility in areas where land development, etc. is concentrated in the several locations. It is suggested that a separate impact statement be developed and circulated for comment on each geographical land development or on shore use when details are known.

Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

MEMORANDUM

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

TO Director
Office of Environmental Affairs/DEIS

DATE: April 4, 1977

FROM Principal Environmental Officer/R

SUBJECT DEIS:DoI/BLM 1977 Outer Continental Shelf Oil and Gas Lease Sale No. 43, South Atlantic - NEW Control #835

The FDA is the only agency within the PHS which is concerned with activities such as the subject oil and gas lease sale. As you note, the most serious environmental impact anticipated would occur in the event of an accidental oil spill. Most of the others are transitory and short-term resulting from installation of drilling platforms, drilling operations, pipelines, etc.

No. 5 of the attached comments would provide an opportunity to reduce long-term adverse environmental effects on a timely and sound basis.

Boris J. Ostheroff

Enclosure

Director, Environmental Impact Staff (HFF-416) - Page 2

Notification would permit these agencies to take timely action in preventing the harvesting and marketing of marine food species which may become subject to contamination.

George Morrison

MEMORANDUM

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
FOOD AND DRUG ADMINISTRATION

TO Director
Environmental Impact Staff (HFS-30)

DATE March 30, 1977

FROM Deputy Chief
Shellfish Sanitation Branch (HFF-417)

SUBJECT Comments on OCS Environmental Impact Statement

We have reviewed the Draft Environmental Impact Statement on the Proposed 1977 Outer Continental Shelf Oil and Gas Lease Sale South Atlantic OCS Sale No. 43 and submit the following comments:

1. We found the document adequately covered the potential adverse impact on marine life including scallops, oysters, clams and crabs from the installation of drilling rigs, pipelines, and potential oil leakage and spills associated with the development of oil and gas resources under the South Atlantic outer continental shelf.

2. From the available information it would appear that installation of drilling rigs or platforms would have little adverse affect on bay scallops, oysters and crabs. Only the sea scallop which is located off-shore may possibly be directly effected by drilling operations.

3. We concur with the information in the document that in the event of continuous leakage from the wells or a massive oil spill in which the oil reaches the benthic habitat of shellfish, there will be an adverse impact on these organisms.

4. Any large scale dredging for oil pipeline installation through shellfish beds would cause shellfish injury or mortality from physical disruption or smothering from silt and other dredged material.

5. If the proposed lease development leads to the establishment of oil wells and subsequent pipelines in proximity to scallop, clam, oyster or crab habitats, and in the event an oil spill does occur the Federal Food and Drug Administration and State health and shellfish control agencies should be notified.

aims

AMERICAN INSTITUTE OF MERCHANT SHIPPING
1625 K Street, N.W., Suite 1000, Washington, D.C 20006
Phone 202/783-8440

April 14, 1977.

Bureau of Land Management
Department of the Interior
OCS Office
Hale Boggs Federal Building
500 Camp St., Suite 841
New Orleans, Louisiana 70130

Gentlemen:

OCS OIL AND GAS LEASE SALE #43 OFF THE SOUTH ATLANTIC SEABOARD

This letter sets forth the position of the Tanker Council of the American Institute of Merchant Shipping (AIMS) which, for the purpose of this subject, disassociates itself from the Institute.

The AIMS Tanker Council, representing 60% of the total active tanker tonnage of the United States, believes that safety of navigation and the prevention of marine pollution are paramount considerations which must be taken into account when evaluating the desirability of developing offshore exploration and subsequent drilling and producing operations.

It is our firm belief that an accommodation can be developed that will serve the reasonable needs of both the shipping interests and the offshore developers and which will provide a maximum degree of safety of navigation and pollution prevention. To this end, we stand ready to actively participate in developing such an accommodation when the need arises.

However, at the present time, taking into account that much exploratory work must be accomplished before the producing phase is started, we believe that the establishment of fairways is premature and could seriously inhibit the exploratory program which is certainly in the national interest. It is our opinion that during the initial exploratory drilling, which would involve very limited areas and little equipment, the presence of such equipment would pose no problem to navigation interests. The equipment would of course be lighted and have on board all navigational aids in accordance with Coast Guard requirements.

When the results of the exploration work become known and before the production drilling phase starts up, fairways could be established taking into account the interests of all concerned and, as has been stated above, we stand ready to assist in developing such fairways.

In summary, we believe that fairways will become necessary and we will strive to develop the best and safest ones possible.

We are grateful for the opportunity to make these comments.

Sincerely,

O. R. Menton
Chairman, Tanker Council

In commenting on similar recommendations made by the Fish and Wildlife Service (FWS) for OCS Sale No. 44 in the Gulf of Mexico, the Bureau of Land Management (BLM) pointed out that the U.S. Geological Survey (USGS) Oil and Gas Supervisor consults with BLM and FWS concerning the development of mitigating or protective measures for each OCS permit application (FEIS, Sale No. 44, page IX-12). However, it is our experience that recommendations that have not been agreed to prior to the lease sale and made a part of the actual lease agreement are frequently rejected.

It is possible that BLM envisions using the Department of the Interior Secretarial Order No. 2974 (S.O. 2974) as the primary vehicle for protecting sensitive biological communities in the South Atlantic OCS Area. However, it is our opinion that the best and most clear-cut route to protect "live bottom" and other sensitive biological communities is through the inclusion of protective stipulations in the lease agreements, rather than the dependence upon S.O. 2974 or other uncertain coordination routes.

In addition to the stipulation changes outlined above, we strongly urge the inclusion of two additional stipulations that were recently drafted for Gulf of Mexico OCS Sale No. 47. We recommend that these stipulations be included in all leases issued for oil and gas operations in the South Atlantic OCS Area, unless appropriate alternative processes are developed. These proposed stipulations are as follows:

1. Maps showing an interpretation of the bathymetry and geologic and engineering hazards (e.g., shallow gas, geopressure, sediment stability, fractures, and/or such dangers that could destroy platforms or drilling rigs and thereby harm the biota) shall be prepared and submitted to the Manager, New Orleans OCS Office for his review prior to the commencement of any drilling activities.

2. No drilling permits will be issued by the Supervisor until he has found that the lessee's exploration and development plan filed under 30 CFR 250.34 is adequate to insure that exploration and production operations in the leased area will have no significant adverse effect on the biotic communities associated with the high value reef sites. As a part of the development plan, a reef monitoring program must be included.

   The monitoring program will be designed to assess the effects of oil and gas exploration and development operations on the viability of the coral reefs and associated communities. The development plan should indicate that the monitoring program will be conducted by qualified independent scientific personnel and

that program personnel and equipment will be available at the time of operations. The monitoring team will submit its findings to Regional Director, U.S. Fish and Wildlife Service; Manager, New Orleans OCS Office, Bureau of Land Management; and Supervisor on an interim on-going basis, or immediately in case of imminent danger to the reefs resulting directly from drilling or other operations.

We also strongly recommend that a special stipulation be developed to require the use of bird repelling techniques during appropriate oil spill situations, as discussed in Section VIII.D., Other Alternatives Within the Proposed Action. This seems like a minimal requirement and common sense approach to protect one of the most important avian flyways in the entire world.

The Fish and Wildlife Service is particularly concerned that inadequate information is available concerning qualitative and quantitative aspects of pelagic bird distribution and life history. It is undeniable that pelagic birds would be heavily impacted by an OCS oil spill, yet inadequate information exists to allow for a reasonable assessment of this potential impact.

The Fish and Wildlife Service has expressed its concern on a number of occasions that the potential onshore impacts of OCS development are not properly addressed in OCS impact statements. This criticism applies to proposed OCS Sale No. 43, as it does to past and currently proposed sales in the Gulf of Mexico, Mid-Atlantic, and Pacific OCS areas. The treatment of endangered species in the draft environmental statement is inadequate. Specific comments concerning endangered species are covered below. We want to stress the fact that operations resulting from the proposed lease sale have potential to adversely affect endangered species and their critical habitat.

Specific Comments

Page II-113, paragraph 5

The statement is made that, "Further work is being conducted regarding population densities and habitat of manatees by Reynolds at the University of Miami." Personnel at the Fish and Wildlife Service Laboratory, Gainsville, Florida, are performing intensive research on the biology of both the endangered manatee and the endangered American crocodile in South Florida.

Page II-122, Birds of Prey

The Everglades kite, although discussed in the later section on endangered species, should be listed in this section.

Page II-125, Cranes, Lumpkins, Rails, and Coots

Lumpkins should be Limpkins.

ADDRESS ONLY THE DIRECTOR, FISH AND WILDLIFE SERVICE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240

In Reply Refer to
FWS/OBS

APR - 8 1977

MEMORANDUM

TO: Director, Bureau of Land Management

FROM: Associate Director, Fish and Wildlife Service

SUBJECT: Comments on Draft Environmental Statement for Proposed OCS Sale #43, South Atlantic

We have reviewed the draft environmental statement for the proposed outer continental shelf oil and gas lease sale in the South Atlantic (OCS Sale No. 43). Our review has centered on those aspects of the proposed action that impact or otherwise relate to fish and wildlife resources. We offer the following comments for your consideration.

General Comments

We are concerned by what we perceive as a weakness in the biological stipulations presented in sections IV.D. and VIII. These stipulations require the lessee to submit a bathymetric map indicating the locations of "live" or hard bottom areas as a part of his exploration and/or production plan, along with bottom photographs and interpretations of geologic or engineering hazards data. The intent is obviously to locate potentially sensitive biological areas. Once located, however, there is nothing in the stipulations that would afford any degree of protection to these sensitive areas. This is totally inadequate. As a minimum, we urge that the biological stipulations be enlarged to provide for such protective measures as prohibiting the siting of structures on the tops and slopes of "live bottom" areas, transporting drill cuttings and drilling muds to approved offshore or onshore locations, shunting of drill cuttings and muds to within close proximity of the ocean floor when drilling operations are near high-relief banks, and/or prohibiting the discharge of drilling muds and mud additives in the vicinity of "live" or hard bottom areas.

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

Page II-126, paragraph 11

The introduction to the Endangered Species section should include a brief discussion of the designated critical habitat concept.

Page II-127, Table E-15

The listing of endangered species occurring in the U.S. South Atlantic region is incomplete, and should include the following:

Eskimo curlew	Numenius borealis
Ivory-billed woodpecker	Campephilu principalis
Blue whale	Balaenopters musculus
Finback whale	Balaenopters physalus

Page II-128, paragraph 12

It is stated that the areas of concern are the high energy beaches which the sea turtles utilize for nesting. While this is true, consideration should also be afforded the primary habitat of these species, the ocean environment. A thorough discussion should be presented on protected sea turtles whose restricted nesting areas have been generally defined in South Atlantic states. An updated resource report on sea turtles was recently provided to BLM for OCS Sale No. 47, and contained much information pertinent to the proposed South Atlantic sale area.

Page II-129, paragraph 3

We disagree with the statement that the West Indian manatee "is presently on the increase in Florida and its range has extended to South Caroline." Current evidence does not indicate a population increase, and the range has not been extended. Recent data has revealed a greater range on the Atlantic Coast than was previously known, but this is not a range extension by the species. Quite the contrary; the manatee is no longer seen in many parts of the northern Gulf of Mexico and South Atlantic areas where it formerly occurred in abundance.

Page III-6, Section 2

In the section on geologic hazards, the potential impact of a blowout on marine biota should be thoroughly discussed. Several pages of the environmental report are devoted to the impact of drill cuttings and mud on biota, yet these impacts may be small in comparison to the impact that a single large-scale blowout might have on marine organisms. For example, in late 1976 a major blowout occurred in the Gulf of Mexico, creating a huge crater-like depression on the ocean floor estimated to cover some 200 acres. The extent of damage

to marine life through smothering and various other forms of mechanical damage is unknown. On page III-9, paragraph B, it is estimated that between one and three blowouts will occur during exploration and production in the South Atlantic lease area. For this reason alone, the impact of blowouts on biota should be addressed.

It is important to note that there is currently no mechanism set up to allow the review of geologic hazards data by agencies responsible for the protection of marine biota. One of the proposed special stipulations cited above, if adopted, would help to alleviate this problems.

Page III-46, paragraph 5

In the section on impacts on benthos, it is stated that "baseline biological studies to determine benthic distributions will be made under contract to BLM before any drilling activity takes place." Is this statement still true, and if so, how will the baseline data be used to protect benthic organisms? What mechanism will be used to require mitigative actions to protect biota?

Page III-47, paragraph 2

It is stated that "while it cannot be conclusively stated that these chemicals (drilling fluids) have an effect on the benthos, observations in the Gulf of Mexico during more than 20 years of operations indicate that such effects, if present at all, are minimal." While this may be technically true, it should be noted that predrilling baseline conditions are largely unknown, no research has ever addressed this problem directly, and site specific data are almost totally lacking. Thus, we believe the above-quoted statement to be misleading and recommend that it be deleted or properly qualified.

Page III-50, paragraph 7

Although "there have been no investigations performed regarding the results of manatee ingesting contaminated food," it can logically be concluded that contact with, inhalation, and ingestion of spilled oil would have detrimental impacts as discussed under the section on pinnipeds. Oil spills would also jeopardize the designated critical habitat of the manatee.

Page III-50B, Section 7

It is stated that "no direct toxic effects on benthic biota are expected from the disposal of drilling fluids during the exploratory phase." However, no mention is made of toxicity in the following discussions on field development and production phases. Since biocides are commonly employed in these phases, toxicity from the disposal of drilling fluids would reasonably be expected. A thorough discussion of biocides and other potentially toxic mud additives is recommended.

Page III-51, paragraph 9

The statement that "the maximum size of a turbidity plume in the Gulf of Mexico was 20 m wide and 800 m long" is misleading or erroneous. We have seen photographs of a turbidity plume from a drilling rig offshore Texas that extended well over a mile in length.

Page III-66, Section 4.A.

The discussion on pages III-66 and III-67 paints a bleak picture regarding the impacts of oil on birds in offshore environs, quoting such statistics as (1) at least a 57 percent probability that an oil spill occurring within the proposed lease area could affect the endangered Arctic peregrine falcon, and (2) a 23 percent probability that an oil epill near Currituck and Pamlico Sound in North Carolina would affect such species as the greater snow goose and the whistling swan. Then, amazingly, the section is summarized by the statement that "it is not expected that there would be any serious impact on the bird population of the South Atlantic as a result of this proposed sale or any future sale in the area." How can this statement possibly be justified?

Page III-69, Section 5

A discussion should be presented in this onshore endangered species section on OCS activities which could impact designated critical habitats and the resultant Section 7 consultation procedures that would be required under the Endangered Species Act of 1973.

Page III-70, paragraph 3

The brief discussion of impacts on sea turtles is totally inadequate. See our previous discussion of this topic.

Page III-70, paragraph 5

The statement that "any impacts to endangered species . . . would be minor, temporary, and confined to small specific areas, and a few individual animals so that only a small part of the population in question would be affected" shows a basic misunderstanding of the entire endangered species concept. We wish to stress that, with endangered species, the loss of even a "small part of the population" can be of major consequence to the survival of the species.

Page IV-1, Section A.1

We recommend that a detailed discussion of the E.O. 2974 mechanism be included in this section on Department of the Interior Mitigative Measures.

Page IV-1, paragraph 3

A discussion of the point raised in this paragraph should be included (i.e., that the stipulations are not legally binding unless approved by the Secretary and placed in the actual lease agreements issued as a result of the proposed sale). Many people that we have talked to are under the erroneous impression that, if a stipulation appears in the final environmental statement, it is legally binding upon lessees. As we have discovered a number of times in the Gulf of Mexico, this is not true. We feel that this point should be thoroughly discussed in the final environmental statement.

Page IV-4, paragraph 5

The statement that proposed South Atlantic OCS Operating Order No. 7 would "in effect eliminate the potential impacts on biological communities, water quality, commercial fisheries, offshore recreation. . ." is completely erroneous. Implementation of this proposed Operating Order might help to mitigate the impacts on these diverse areas, but they would not eliminate the potential impacts. Only cancellation of the proposed sale would eliminate these potential impacts.

Page XI-43, Appendix E

Secretarial Order No. 2974 was revised on January 19, 1977, and should appear in place of the original version presented here.

We appreciate the opportunity to review and comment on the Draft Environmental Statement for proposed OCS Lease Sale No. 43. We hope that our comments will help strengthen the Final Environmental Statement, and that they will be beneficial in the decision-making process regarding this proposed sale.

J. Eugene Hester

Natural Resources Defense Council, Inc.

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April 15, 1977

Manager
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Hale Bogge Faderal Building, Suite 841
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New Orleans, La. 70130

Dear Sir:

Enclossd are Comments of the Natural Reeources Defsnss Council, Inc. on the Draft Environmental Impact Statement on Sale 43, in the South Atlantic. These comments ars supplementary to oral tsstimony at the public hsaring held March 31, 1977 in Charleston, South Carolina.

Sincerely yours,

Frances Beinecke

Frances Beinecks

FB:mvr

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Comments of the

Natural Reeourcee Defense Council, Inc.

on the

Bureau of Land Management'e

Draft Env:ronmental Impact Statement

on

Proposed Sale 43, in the South Atlantic

April 15, 1977

Frances Beinecke

Sarah Chasis

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The Natural Resources Defense Council, a national non-profit environmental organization, submits the following commente on the Draft Environmental Statement (DES) for Sale No. 43 proposed for the South Atlantic. These comments ars supplementary to those submitted orally at the hearing held by the Department of the Interior in Charleston, South Carolina on March 31, 1977.

NRDC's position on the accelerated leasing program is outlined below, along with revisions in the existing program which NRDC believes tp be paramount if the program is to be conducted in an environmentally sound manner.

NRDC has never bsen opposed to the drilling for oil and gas on the OCS Atlantic Coast. However, the program, as prseently structured, poses seriouś and unnecsesary threats to the coastal and marins environmente, to the socio-economic make-up of the shoreline communitiee and to the tourist, recreation and fieheries sconomiee which ars significant to these communities. In order to avoid detrimental impacte on productive coaetal reeourćes, particularly wetlande and sstuaries, we feel that the OCS leasing program ehould be modified in eevsral ways, including the following:

1) Separation of exploration from development and production, either through government eponeored exploration or separate leasing for exploration ehould be required. This would permit the government to dstermine ths nature and effect of hydrocarbon resourcee on the shelf and to complete the baseline environmsntal studies before leasing of development and production rights occur.

2) All leasss should include a provieion which permite the Secretary to terminate the lease if long term environmental damage ie threatened, or if a biologically eensitive area is identified after the lease sale.

3) The best available and eafeet mode of transporting oil and gae ashore must be requirsd in the special etipulatione for leases in frontier areas. This is particularly important where areae to be traversed are as ecologically productive and vulnerable, as are the live bottom areae in the South Atlantic. (p. II-150)

4) An anvironmental impact statement should be prepared aftar exploration, before development and production is permitted, to allow maximum preparation and planning by ehore communities and etates for impacts and facilities rssulting from the OCS leaee sale. Interior Secretary Andrus has announced that such a statament would be required in the Mid-Atlantic as s reeult of laase Sals 40. Thie requirement should be extanded to all frontisr arsas.

5) Best availabla and safast tachnology must be

rsquired for all phases of leasing opsrations where necessary to protect public safety, health, and the environment. Eguipment must be inspected and a rigorous program of enforcement must be developed and followed by the responsible federal agenciss.

These recommendations for adjustments in the OCS leasing program havs been made repeatedly by NRDC and other organizations concerned with potential environmental damage rising out of the accelerated leasing program. Many of these reforms are included in two pieces of legislation presently pending in Congress to amend the Outer Continental Shelf Lands Act of 1954, (H.R. 1616 and S. 9).

Of primary concern to NRDC are the potential impacts on the fisheries, wetlands, estuaries and barrier islands of the Southeast Atlantic Coast resulting from Sale 43. The South Atlantic marine and coastal environments have long been recognized as areas of high productivity and relatively undamaged marine, and estuarine ecosystems.

Georgia, South and North Carolina have 68 barrier islands which protect the salt marshss, estuaries and coastal communities from the open ocean. The barrier islands themselves are well known for their maritime forests and fresh water sloughs which allow habitats for many unique and endangered varieties of birds and animals. These islands also

provide now and to an increasing degree in the future, many thousands of peopls with valuable recreation experiences. From the Outer Banks to Cumberland Island, islands are important recreation resources.

The Islands also protect what is known as "one of the largest coastal salt marshes in the world."*/ These marshss themselves provide the estuaries with important nutrients for the anadramous fisheries which spend some part of their life cycle in these waters. Eugune Odum has estimated the annual return from an acre of marsh estuary to be $4,100 for total life-support value.**/ At a time when these resources are vanishing at an alarming rate because of development and dredging programs, it is necessary for any government-sponsored project to take every necessary precaution to ensure their protection. NRDC does not believe that potential impacts to these resources from OCS activities and accidents has received adequate attention in the Draft Statement or in the program planning.

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*/ Bruce Freeman and Lionel Walford, Angler's Guide to the United States Atlantic Coast, Nstional Marine Fisheries Service, Section IV, p. 7, July 1976.

**/ J. G. Gosselink, E. P. Odum and R. M. Pope, "The Value of the Tidal Marsh," Center for Wetland Resources, Louisiana State University Press, 1974.

COASTAL RESOURCES

Of primary concern in the Draft Environmental Impact Statement is the consideration of the coastal and marine resources for which the South Atlantic Coast is well known. These include the wetlands, estuaries, barrier islands, the live bottom areas, and ths marins organisms associated with each of them. After a careful review of the various sections in the DES relating to these resources, the final impression is that there are large gaps in information and that the BLM has not adopted a program which will adequately ensure their protection.*/

Repeatsdly the DES maintains that gaps in information exist, specifically in reference to the location of live bottom areas, and species and population distribution of marins organisms. (II-115, III 44, III 46). The description of the Environmental Studies Program should contain a procedure whsreby this information becomes available in a timely manner. (I-6). However, the Environmental Studiss Program is seriously deficient in a number of key srsas. Thsse are most succinctly outlined by the Interior Depsrtment's Environmental Studiss Advisory Committee.*/ Ths conclusions of the Subcommittee for Review and Evaluation after an analysis on the South Atlantic program are that

1) Major biological objectives of the BLM Study Plan will not be met by studies described in currently available Reguest for Proposals.

2) Several biological objectives of the Study Plan will be only partially and imperfectly met by studies described in the RFP.

3) Most of the biological recommendations of the BLM sponsored Confsrence/Workshop or the Environmental Study Program for the South Atlantic OCS Areas have not been incorporated into either the BLM Study Plan or the RFP.**/

A major area of concsrn was that studies on the

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*/ Sections analyzed include I.C.3. Environmental Studies Program; II.E. Biological Communities; II.F. Biological Environments of the Coastal Zone; II.G.5. & b.d. Fisheries; III.B. Offshore Impacts on the Nstural Environment; III.C.6, Commercisl Fisheries; III.D. Onshors Impact on the Natural Environment; III.2.f. Sports Fishing; IV.D Spscial Stipulation; V. A. & C., Adverse Impacts, VII.B. Fish and Wildlife Resources.

*/ OCS Environmental Studiss Advisory Committee, Official Record, November 18-19, 1976.

**/ Ibid., pp. 4-5

effects of oil and trace metals on marine organisms were not included. A continuing concern of NRDC throughout the OCS program has been that the effect of chronic oil contamination on marine organisms has not been adequately evaluated or proposed for thorough study in any of the proposed Atlantic leasing areas. Major recommendations which are not included in the environmental study program are

> "all studies of biological process dynamics, i.e., studies of microbical heterotrophic potential, nitrogen fixation, and sulfur metabolism; studies of trophic bio-accumulation of potential oil and gas pollutants; and community metabolism and energy flux"...*/

NRDC believes that the Environmental Studies Program must contain adequate information both to provide the Secretary with the information required to make decisions concerning the OCS leasing program, and also to provide the base information which will be used to evaluate changes in the environment resulting from OCS operations. This program does not accomplish that end,**/ because there is no indication how any information obtained in the Study Program will be used in the program planning.

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*/ OCS Environmental Studies Advisory Committee, Official Record, November 18-19, 1976, pp. 6-7.

**/ Order Number 2974 of the Secretary of Interior in Appendix E is intended to involve the Fish and Wildlife Service in the environmental analysis aspect of the Leasing Program. However, the stated expiration date of the Order was December 31, 1976, so its utility is unknown.

plumes. Although NRDC believes that there are areas of probable impact, there seems to be a dearth of additional information. No attempt to interpret the significance of these impacts has been made. In all cases, the conclusion is that impact on each resource will be adverse locally but negligible generally. (III, 45, 46, 47, 48, 49). The problem in this conclusion is that the BLM is basing its determination of negligible without adequate information, and by diluting potential impacts in certain areas in the vast region of the South Atlantic. What is not fully discussed is the relationship of various species to one another, and the variability of year classes, particularly relating to nekton. Even if a species survives an impact, a localized area might be radically disrupted which is vital to the life cycles or food chains of other organisms.

An analysis is necessary which weighs the cumulative impacts on the marine biota from an oil spill. How severely would an ecosystem be disrupted if individuals from a variety of species and trophic levels were severely disrupted? Would the biological community change from that of a diverse, stable community to one where the primary species are indicators of stress conditions? If the latter is probable, then the impact is indeed severe. Furthermore, the toxicity of petroleum hydrocarbons to marine organisms, at high levels resulting from spills, and of low levels of chronic discharge are not adequately assessed in the DES.

Generally the DES does not give detailed information which can be used in planning to avoid negative impacts. The reason is apparently that the impacts on biota cannot be assessed when the specifics on the distribution and productivity of the species are not known. This is exactly the reason why NRDC's position that development not proceed prior to the completion of environmental baseline studies is strongly supported by the paucity of specific information contained in this DES. The BLM needs first to find out as much information as possible in these areas, and second, to develop a program which incorporates their knowledge into development decisions and provides mechanism for control.

In addition to the marine organisms themselves, the geologic structures and floral communities associated with them are unique in the South Atlantic. Included are the barrier islands, estuaries and salt marshes which line the coast. The DES describes the high level of productivity and large areas covered by these resources in Section II. A major omission is any discussion of the Sapelo Estuary, behind Sapelo Island, located directly opposite the proposed lease area. The Sapelo Estuary has been identified under Section 312 of the Coastal Zone Management Act as an estuarine sanctuary, to be protected and used for research purposes. This unique resource deserves consideration in the DES for potential impacts which could seriously impair its protected status. Section III, however, fails in the description of

Eugene Odum, in a recent article in Science, pinpointed the pervasive problems of environmental impact statements' approach to biological communities:

> "...environmental impact assessment, as well as technology assessment in general, should move from a mere component analysis, wherein factors and organisms are treated as if they were independent entities, to more holistic approaches wherein interactive, integrative and emergent properties are also included."*/

The Bureau of Land Management would do well to organize its Environmental Studies Program in a manner compatible with recommendations made by its own Advisory Committee, and along the lines recommended by Dr. Odum.

Section III of the DES, Description of the Environment, contains information on what is presently known about the species, distribution, and productivity of the various levels of marine biota, including phytoplankton and zooplankton, benthos and nekton. Because the information on these resources is limited, it is no surprise that Section III, describing impacts, does so in a cursory fashion. The DES concluded that the marine biota will receive adverse impacts from oil spills, and turbidity

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*/ Eugene P. Odum, 1977. "The Emergence of Ecology as a New Integrative Discipline." Science, Vol. 195, p. 1292.

impacts. Impacts on beaches and wetlands are described as produced by pipeline burial and oil spills. (III 64-65). The attitude, particularly in the wetlands section, is that the technology has been developed to minimize impact. However, what is not discussed is the feasibility of not crossing either of these areas.

Furthermore, the DES does not adequately describe the impacts resulting from the transport of oil by tanker. This possibility significantly alters the likely source of impacts. The risk of both oil spills and the size of the area which could be affected is substantially increased. This necessitates analysis of what nearshore areas must be avoided by tankers, and trajectories taken from likely tanker routes. No analysis of this sort is attempted in this DES. (III 19). In reading through it, specific areas of high productivity, particularly the North Carolina estuaries (II 186, 187) are described, but no attempt is made to devise a program which would avoid impacts in these particularly vulnerable areas. In fact, North Carolina is exactly where the trajectory model has determined the oil would go. A Special Stipulation should be incorporated into Lease Sale 43 which requires the best available technology and safest mode of transporting oil.

Oil Spill Trajectories

The oil spill trajectories for the South Atlantic as described in the DES present two problem areas. First, the study determined that the two areas most likely to be reached if oil is spilled in the lease areas is the Florida coast, where much of the economy is based on ocean-based recreation, and the North Carolina coast, where the estuaries are very valuable to the fisheries which are estuarine dependent. Because these two areas are recognized as extremely valuable mainstays to natural resource based economies, the DES must assess the "costs and risks of the proposed action and each reasonable alternative."*/ The DES does not assess the potential cost of this action on those resources.

Another problem with the analysis is that eight trajectories were taken from within the lease area while a major source of spills is oil transport, which occurs outside of the lease area. If the oil is transported by tanker, as is proposed (I-3), a trajectory analysis should be done for likely tanker routes.

The results of this model show the oil from an

*/ 40 CFR 1500.8 (a) (4).

offshore spill going north or south, bypassing South Carolina and Georgia. However, it is harbors in these two states, specifically in Charleston and Savannah, where the oil may be transported. The nearshore resources, particularly the estuaries and wetlands, would most probably be affected, but this is not analyzed in the trajectory analysis.

Human Utilization

The Draft Statement in describing the existing Port Facilities and Transportation systems (II 156) indicates that the South Atlantic has petroleum storage facilities, but no refineries; and has no traffic separation system leading into these ports, or fairways along the coast.*/

Section III, on Impact, states that 25,000 dwt tankers will be used in this Lease Sale (III-55). The DES does not indicate whether the tankers will be going into the South Atlantic ports to store the crude, or directly to the Mid-Atlantic for refining. The probable areas of impact will be substantially different depending on the routes the tankers take and the frequency of

*/ In this section, the DES refers to both the Intracoastal Waterway (p. II 156) and the Intercoastal Waterway (Table 6-12). Are these the same?

trips. Neither the routes nor the impacts from tanker trips are adequately described in the DES.

The routes taken will also have an impact on shipping because no identified "fairways" exist in the South Atlantic. Although the DES (III-55) points out the problems associated with cross-coasting traffic, it does not indicate that federal agencies can minimize potential impacts.

The discussion on foreign crude imports varies throughout section III (c) of the DES. Paragraph 2 (III-55) discusses both decreases and increases of foreign crude imports. III-58 indicates that any oil in the South Atlantic would result in increased port use because foreign crude is not presently brought in to South Atlantic ports. What continues to remain unclear is whether crude oil would be brought by tanker into the South Atlantic ports. If it were, an impact of the proposed Sale which is not discussed in the DES is that of transporting the crude from these ports to the refineries, whether in the Gulf or Mid-Atlantic regions. What routes would the tankers take? If it were through the Intercoastal Waterway, potential impacts from spills on the wetlands and estuaries all along the coast would be increased significantly. This is not discussed in the DES.

An additional problem with this section is the assumption that no refineries are needed and that a portion of the crude will go to the Mid-Atlantic refineriss (III-29). This is the third Atlantic Draft Statement which assumes that the Mid-Atlantic refineries can accommodate the oil from s lease Sale.*/ However, the initial assumption in the Draft Statements was that OCS Sales would replace foreign crude. This DES must assess the impacts of increased refinery capacity, either in the Mid-Atlantic or South Atlantic, whichever the projections assume to be the more likely location. Accompanying land use and air quality impacts from expanded refinery capacity must slso be fully examined.

The description of existing land use clearly indicates that the South Atlantic cosstal counties are heavily based on natural resource economies through forestry, agriculture, fishing, and conservation. One would assume that rscreation is slso a significant economy in some regions. The impsct statement is incomplete in its snalysis of the recrestion snd tourist industry (II-266). There are no figures on the sconomic valus of these industries to the

*/ Ssle 40 EIS, vol. 2, p. 217.
Sale 42 DES, vol. 2, p. 903.

coastal communities.

The discussion of impacts on Recreation Areas and Activities (III-113) is lacking in any assessments of the economic losses potentially generated by oil spills, or conflicts with recreation usage resulting from developing oil industry in the area. Much effort is taken, as in other sections, describing the impacts from pipeline construction. However, the DES neglects to discuss impacts from pipeline operations, particularly the impacts from possible leaks and ruptures.

Furthermore, both the trajectory and matrix analyses indicate that Florida and North Carolina beaches are likely to be affected by oil spills. The seashores in these two states are heavily used as recreation areas. Some assessment of economic losses resulting from such a spill, both in the long and short term, must be made in the Draft Statement. The DES chooses to minimize impacts to the recreation economy, as indicated in the following statement: "Consequently secondary impacts on recreation are projected to be minimal when considering the economic and land modification effects on the broad South Atlantic Seaboard," (III-117). As indicated previously, impacts are minimized whsn compared to large

scale areas. Localized impacts would be severe, as they sould affect s vital industry of a community. The DES chooses to ignore this by speaking only in broad regional terms.

The estimstes of acreage utilized by oil related activities resulting from this aale totals 270 acres (III 176). This estimate is for the acreage required by a number of facilities. The total acreage estimate is substantislly understated becsuse: (1) it includes only primary uses; (2) it omits a number of facilities which might be developed in the area because of the sale; (3) the estimates of acreages for the facilities listed is below thst found in other studies of off-shore oil activities.

Specific examples of problems in the DES are the following: No examples are given of acreags required for infrastructure development occurring becsuss of this sals. Becsuse there is no oil based industry in the region now, snd much of the region is quite rursl, significant impacts could result in local communities because of servics snd housing requirements. The DES omits acresge requirements for s potential refinery, pipecosting facility, or s platform construction site. Acreage requirements for s gas processing plant are estimated to be 20 scres in the

DES, but 75 in the Woodward Clyde Study sponsored by the American Petroleum Institute, and 25-100 acres by the BDM Corporation contracted by ths Office of Technology and Assessment. These sre three exampls of whsre the DES seems to be minimizing the discussion of land use impacts, which hsve proven to be quite significsnt in many rural areas, particularly in parts of Scotlsnd.*/

Local Authorities

The potential strengths of local governments were a major consideration in the federal district court's decision to void lease Sale 40. The BLM has made only a minimal attempt to evaluate these suthorities in Section I of the DES. There are listings of what kind of authorities exist in various counties. However, the DES does not attempt to fully evaluste the affect that existing regulatory authorities, both at the state and local levels, will have on this program. Furthermore, there is no full description of existing local authorities or gaps in those authorities that presently exist, which would augment onshore impacts resulting from Lease Sale 43. The final EIS on this Sale must attempt to fully consider these authorities and the problems and benefits which might result from their use.

*/ Pamela and Malcolm Baldwin, Onshore Planning for Offshore Oil, Lessons from Scotland The Conservation Foundation 1975

The DES failed to consider the impact that the existence and use of state and local land use controls could have on the leasing program.

Mitigation

Mitigation of impacts on the natural resources, both marine and coastal, from Lease Sale 43 must be developed prior to the Lease Sale. Section IV of the DES discusses mitigation measures now planned for this Sale. The proposed mitigative measures are lacking for the following reasons.

First, there are insufficient means proposed to protect valuable resources, specifically live bottom areas, after the identification of their location. Stipulation No. 1 reguires the mapping of these areas by each lessee around a drilling area. However, there is no technigue for protecting the region, either by allowing the Secretary to terminate a lease if a biologically vulnerable area is identified, or to alter the condition of the lease to ensure the protection of these areas. The technigue used in the Operating Orders and the Stipulations is to reguire all kinds of technological safeguards. There is never the suggestion that certain areas may be found to contain a very high risk, and should not be drilled in at all.

The discussion of oil spill containment and clean-up

indicates that the existing systems contain certain shortcomings. The first problem is the guestion of jurisdiction and liability between the 12 and 200 mile limit. It appears that the responsibility for this area lies more with the lessee than with federal agencies (IV-10). Operating Order 7 on prevention of pollution, contains a requirement for each platform to have oil spill containment eguipment and an oil spill contingency plan. There is no discussion of how much eguipment and what enforcement system will go with it. An Operating Order should be included which requires best available technology, and a specific enforcement procedure. Furthermore, the guestion remains as to which group, the federal agency or the lessee, has the responsibility of rushing to the scene of s tanker spill outside of the lease area and beyond the 12 mile limit?

In the discussion of the respective responsibilities of the Army Corps and the Coast Guard, there is no mention of a system to avoid navigation problems outside of the lease sale area, specifically a recommendation for traffic lanes. If both service vessels and tankers are going to be operating in this area, the DES should consider ways to mitigate potential hazards resulting from the increase in traffic.

This section discusses the proposal to acguaint state governments with proposed impacts through "Notice of Support Activity." Operating Order 15 discusses submission

of lessee's development plans to states. IV-15 discusses notice of support activities to be sent to states with approved coastal zone management programs. There is no reason given as to why states have to have approved CZM programs, and in fact stipulation No. 4 which reguires notice to state for exploration activities contains no such reguirement. All states should be notified of any exploration or development activities which may affect them, regardless of the status of their CZM programs.

Alternatives

The alternatives section of the DES discusses a wide variety of alternatives which would offer greater protection to the "live" bottom areas than the present proposal. It is essential that these aress be identified prior to production and adeguate measures are taken for their protection. The BLM must fully weigh an alternative which would allow this to happen.

The discussion of decreasing the number of tracts is discarded on the grounds that less oil would be produced. This appears to be the overriding theme of the DES, that the oil is greater in importance than the biological resources. The problem with this theme is that no thorough analysis has been made which weighs the long-term value of productive

biological resources with the value of oil production for s short-term period. Furthermore, the rationale for chooaing oil production is that the Sale "could provide significant additions to the nation's domestic production, particularly for use in the South Atlantic Region." The DES contains no assurances that the oil from Sale 43 will be used in the South Atlantic. In fact, if the oil goes to the Mid-Atlantic or Gulf for refining, it is most likely that it will become part of a national distribution system, not projected for the Southeastern states. Furthermore, the BLM has never made an sttempt to evaluate how this program fits into overall energy needs of the nation, or into a rational energy policy.

In the discussion of Alternatives Within the Action, the DES includes: waiting for approved coastal zone management plans, a government exploratory drilling program, suspension between exploration and development, and increased information reguired in the "Notice of Support Activity for Development." These are all positions that NRDC has supported since 1974. The DES does not examine the benefits derived from these options to the natural resources, to the local communities, or to the nation as a whole. Thia section does not discuss the feasibility of separating explonation from development, a major proposal of groups concerned with reform of the OCS leasing program.

Finally, alternative energy sources to the offshore oil and gas leasing program are not examined. The rationale is that the Programmatic EIS contained that information. First, NRDC believes that the Programmatic EIS was inadequate in its consideration of this subject.*/ Second, the amount of energy demand, and domestic trends in energy production have varied since the Programmatic EIS was issued. It is essential that the accelerated oil and gas leasing program continuously update the information on energy reserves and trends, and that the BLM provide that information both to the Secretary of the Interior and to the public through the NEPA process. This has not been done in the Draft Statement on Sale 43.

*/ NRDC comments on Programmatic Environmental Impact Statement, submitted to the Bureau of Land Management, February 1975.

United States Department of the Interior

NATIONAL PARK SERVICE
WASHINGTON, D.C. 20240

IN REPLY REFER TO
L7619-SER-PP
DES 77-6

APR 13 1977

Memorandum

To: Director, Bureau of Land Management

Through: Assistant Secretary for Fish and Wildlife and Parks
Acting ASSISTANT

From: Director, National Park Service

Subject: Draft Environmental Statement for Proposed 1977 Outer Continental Shelf Oil and Gas Lease Sale Offshore the South Atlantic States (DES 77-6) - 1792 #43 (732)

As requested we have reviewed the subject statement and offer the following comments.

General Comments

Identification and discussion of cultural resources is adequately presented in the subject statement.

Location and development of onshore facilities are at best conjectural; therefore, we cannot provide comment at this time on site specific impacts.

Specific Comments

5. Impact on marine mammals, Page III-49-50

Paragraphs 3 and 4 state no dead whales reported or sighted following the Santa Barbara Oil Spills. However, on page III-50 (Pinnipeds, second paragraph) a reference is made that numerous marine mammals including "...grey, sperm and pilot whales..." were found dead after the spill. This apparent contradiction should be clarified.

Visual No. 1 N

Cape Lookout National Seashore includes all of Shackleford Bank. The map should be adjusted accordingly.

James M. Stewart

North Carolina Department of Administration
116 West Jones Street Raleigh 27603

James B. Hunt, Jr., Governor
Joseph W. Grimsley, Secretary

April 14, 1977

Mr. John L. Rankin
Manager, New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
500 Camp Street, Suite 841
New Orleans, Louisiana 70130

Dear Mr. Rankin:

Re: SCH File #029-77; Draft EIS - The Proposed Lease Sale No. 43 - South Atlantic Outer Continental Shelf

The State Clearinghouse has received and reviewed the above referenced project. As a result of this review, the State Clearinghouse finds that no comment is necessary on this project at this time. However, a copy of the North Carolina statement which was delivered at the Bureau of Land Management hearing on South Atlantic Oil and Gas Lease Sale #43 March 28, 1977 is enclosed.

Sincerely,

Chrys Baggett

Chrys Baggett (Mrs)
Clearinghouse Supervisor

CB:mw

Enclosure

RECEIVED
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BUR. OF LAND MGMT.
FINAL
FILE

Statement of the
State of North Carolina

In Regard to the

Bureau of Land Management Hearings on
the Draft Environmental Impact Statement
for OCS Sale 43

March 28 and March 29, 1977
Savannah, Georgia

In the Stata of North Carolina we continuously eaek tha greatast good for our citizens consistent with rational use of rasources and considering the quality of lifs and our enviroe-mant.

Tha racent severe cold weather served to emphasize oaca agaie tha dependencs we have oa fossil fual. The criticality of the fual shortage ia our stata, attandant on tha harsh weather, caused tbe closure of iadustrial facilitias and made it necessary to restrict husinass oparatiag houre as wall as to inetitute a voluatary conser-vation program so that emergancy facilitiee could continue to fuaction and home haatiag would aot be limited.

While the recollactioa of plant ehu'downe, incraaeed unemploy-meat, colder homes and a requeet for aesistance ie raallocatiag fuel hy the Federal govsrnmeat ie etill very real in our miads, it might cause oae to think that North Carolina would instiactively support rapid exploratioa and development of any additioeal potantial fuel sources.

Although we do have a great iateresb in tha eehaacement of our fuel resourcee, we muet coasider aeother facst of tha overall picture ae it applies to our etate. Specifically we direct our attentioe to two of our state's most valuahla resourcee; our coastal laeds and waters. The coaetal araa of our state, whila continuing to enjoy a relatively prietiae anviron*ment, supports aa economy quite dapeadant on the maintenance of its reeourcas as they currently exist.

Even a cursory glaace at mape depicting thoae tracts which have heea nominated for leaeing aad the prohahle path of tha currents creates some concern for the continued well being of our coastal eavironment should widespread exploration and developmeat occur.

Wa therafore have a dual set of concerne in North Carolina which ralate to the Outer Continental Shelf South Atlantic Leasiag program. Thay ara the need for additional fuel sourcee and the aeed to protact our coastal area. We realize that thera ara many praeeures which might attempt to sway our position either to almost total consarvatioe or total dovelopmsnt. We belisve that a middla grouad existe. We have exprassed our positioa in terms of the middla grouad approach at othar times and do so again at this time.

Tha State of North Carolina supports Outsr Continental Shelf eaergy exploratioa and developmaat with adequats safeguards for the environmeatal, eocial, and ecoaomic wall baing of our and other states' coastal areas.

With reapect to the adequacy of the safeguards, the Stats of North Caroliaa requests the option of review and commant on all OCS lease stipulatioas aad oparating orders prior to their approval and further requests assurance that our comments will be considered in the approval process.

North Carolina
Department of Administration
116 West Jones Street Raleigh 27603 (919) 733 7232

James B. Hunt, Jr., Governor — Joseph W Grimsley, Secretary

April 13, 1977

Mr. John L. Rankie, Manager
New Orlaana OCS Offica
Bureau Of Land Management
Hale Bogga Fadaral Buildieg
500 Comp Straet, Suite 841
New Orleane, Louisiana 70130

Dear Mr. Rankin:

A copy of the North Carolina statement which was delivared at the Buraau of Land Managament hearing oa the South Atlantic oil and gas lease eala #43 at Savannah, Georgia on March 28, 1977 is ancloeed.

I would like to reitereate two points made in thet etatement: First; the Stata of North Carolina wants to taka an active rola in the OCS deciaion proceae. Realizing that dacisiona ralated to OCS rest with tha Secretary of Interior who haaas his deciaions on an evaluation of the beet availahle information and advice, the role haing sought by North Carolina is that of an advisor throughout the dacision procaes and into tha immediate pre-decision phaea.

Second; although strong pressuree are continually being exerted from both the developmant and consarvation intaresta, the present state of technology ahould allow for an orderly, well planned, tachnically satisfactory and safe program of OCS development. North Carolina supporta an approach which will provida us with the needed energy resource while eafeguarding tha environmental, social and economic assets of our coaatal and offshora regiona.

I would lika to request that these items ha hrought to the attention of Sacratary Andrus as soon as possibla in order to permit him to decide on the mattar of state involvement.

Bincarely,

Joseph W. Grimsley

JWG:ldl

SIERRA CLUB ☎ Joseph LeConte Chapter
... To explore, enjoy and preserve the nation's forests, waters, wildlife and wilderness ...

April 12, 1977

Manager
New Orlsans Outer Continental Shalf Office
Buraau of Land Management
500 Camp Straet, Suita 841
Naw Orleans, Louisiana 70130

Dear Sir:

Enclosed are comments hy the North Carolina Conservation Committee of tha Joseph LeConta Chapter of the Sierra Club on tha proposed South Atlantic OCS oil and gas leasa Sala No. 43. We hope these comments will be usaful to tha Bureau of Land Management in determining tha optimum mix of usas of OCS lands in the Southeast Atlantic

Very truly yours,

John Warren

J[redacted] L. WARREN
North Carolina Conservation
[redacted] 4217 Laurel Ridga
Raleigh, N. C. 27612

Enclosura

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COMMENTS BY THE NORTH CAROLINA
CONSERVATION COMMITTEE OF THE
JOSEPH LECONTE CHAPTER OF THE SIERRA CLUB

These comments will address the data published in the Draft Environmental Impact Statement in general with several comments specifically related to North Carolina. They are not intended to be comprehensive but to detail key areas of concern the LeConte Chapter believes should be thoroughly discussed by the Bureau of Land Management prior to leasing.

1. Format, General Content

The format is very readable and complemented well by the beautiful, detailed maps. The BLM is to be congratulated on the presentation and ease of access of that material which is included in the Draft Statement. The nature and extent of the data presented is excellent. However, there are many points which the Joseph LeConte Chapter believes the Draft does not address in sufficient detail. Many of these concern general policy and the interaction of this particular OCS sale with the larger problem of a total, comprehensive energy policy for the United States. These comments are discussed in the following sections.

2. Is This Sale Really Needed Now?

Section VIII, "Alternatives To The Proposed Action," gives incomplete consideration as to why this sale is needed now. In particular no significant consideration was given to the alternative of active energy conservation. We would like to call to the attention of the BLM a splendid call to action. "The Wolfcreek Statement: Toward a Sustainable Energy Society." This

statement was a result of a workshop of nine important "thinkers" in the energy field. The following excerpts summarize the ideas of the Wolfcreek participants on energy conservation:

> The largest source of energy available to the United States is the energy we currently waste. Our country ranks only fourteenth among the eighteen members of the International Energy Agency in terms of effective energy conservation efforts....In 1976 Americans wasted more fossil fuel than was used by two-thirds of the world's population. This excess, which currently comprises one-half of our energy budget, represents our nation's largest, cheapest, cleanest, and safest near-term source of new energy.
> ....Enormous energy savings can be made with existing technology without denting industrial productivity.... From 30 to 50 percent of the operating energy in most buildings can be economically conserved now....Conserving energy by substituting labor for energy can help to reduce unemployment. A carefully designed program of energy conservation can create up to 930,000 jobs per quad (quadrillion BTU's) of energy saved.[1]

Thus conservation is possible without necessarily reducing employment but probably increasing it. Conservation should be discussed in detail relative to the proposed sale. What levels of cut-backs would be required by various sectors of energy users to provide the same net energy that may derive from the proposed sale?

Finally, the case for conservation has been supported in a recent General Accounting Office (GAO) report:

> ....For the next ten years, and probably beyond, however, conservation actions appear to us to be the best and most cost-effective way to "produce" new energy. It is also

[1] Available from the Georgia Conservancy, 3110 Maple Drive, Suite 407, Atlanta, Georgia 30305, printed in 1976. Participants included J.W. Benson, Division of Solar Energy, ERDA; C.J. Cicchetti, Department of Economics, University of Wisconsin; H. Daly, Department of Economics, Louisiana State University; D.A. Hayes, The Worldwatch Institute; B.M. Hannon, Director, Energy Research Group, University of Illinois at Urbanna; A. Lovins, Consulting Physicist, Friends of the Earth; E.P. Odum, Director, The Institute of Ecology, University of Georgia; D.W. Orr, Department of Political Science, University of North Carolina; and, C.R. Phillips, Executive Director, The Georgia Conservancy.

> increasingly clear that beyond 1985, conservation must continue to be made a cornerstone of U.S. energy policy to insure that the Nation fully considers energy efficiency.
>
> Conservation has one basic advantage which has not received much emphasis. In many cases conservation actions result in permanent or at least long-term energy savings. Further, the savings are multiplied beyond the actual energy saved at the point of end use. All of the energy needed to get it to the end user is also saved. If conservation actions are not taken, then more energy must be produced each year to meet the inefficient energy uses.[2]

3. Delay of Sale

If the sale is determined to be necessary at all, what are the justifications for holding it in 1977 instead of in later years? Would a delay better suit our long-term energy needs? See the next comment on Environmental Studies Program.

4. Status of Environmental Studies Program

Should the sale in this frontier area be delayed until all pertinent environmental studies are finished so that appropriate baselines are known before rather than after the fact of development? In the National Energy Policy: An Agenda For Analysis previously discussed, the GAO asks the following question:

> What action has the Interior Department taken to establish... an adequate data base? The Interior Department has not responded favorably to our past OCS recommendations, and we plan to review future OCS sales to determine the need for additional steps which might spur the Department to action.

We feel the BLM should answer this decisively for OCS Sale No. 43 and offer justification for why studies need not be completed prior to leasing.

[2] National Energy Policy: An Agenda for Analysis, U.S. General Accounting Office, EMD-77-16, January 27, 1977.

5. Net Energy Analysis Needed

Though an emerging science, net energy analysis can offer excellent insights into the relative amounts of net energy available from various types or sources of energy. The BLM should analyze the potential net energy (simply stated, this is the energy produced from a source after deducting the costs of finding, developing, and delivering that energy to the end user) from the South Atlantic Sale. Then this amount should be compared with that net energy that could be generated by other actions such as an extensive energy conservation program. This question should be discussed in Section VII as there will be irreversible and irretrievable commitment of resources in the energy used to develop the South Atlantic area and in Section VIII on alternatives.

6. Coastal Zone Management Plans and OCS

As noted in Section I, E.2.A, no State adjacent to the proposed sale area has completed or received approval for its Coastal Zone Management Plan. Should not this be sufficient reason to postpone the sale and subsequent OCS development until these CZM plans are finished?

For example, North Carolina's Coastal Area Management Act (CAMA) is regarded by NOAA as probably the strongest in the Southeast. However, it has many weaknesses which may portend problems all coastal states affected by OCS Sale No. 43 may incur in attempting to develop CZM plans which are capable of coping with onshore impacts induced by OCS development.

A recently released GAO report addresses the possible weaknesses in the North Carolina program's authority. The following selections are from the GAO's comments.

> North Carolina may have problems designating AEC's (Areas of Environmental Concern). Our review indicated that coastal zone property owners and local governments foresee

restricted development rights and decreases in property values. Therefore, they will resist any State actions to designate ABC's in their area.
....An indication that these pressures (from industry and developers) are real is the fact that North Carolina delayed designation of ABC's....The commission gave local governments the responsibility for nominating ABC's. This, in effect, postponed the necessity of designating ABC's. The commission finally designated interim ABC's in May 1976, nearly 2 years after it was established.
Another potential weakness is that certain coastal zone resource uses are excluded from coverage under the ABC regulatory system....(an exclusion) that could be particularly significant is:

> Construction by any utility developing, generating, and transmitting energy, to the extent that such activities are regulated by law or by present and future rules of the State utilities agency.

....The commission does not have direct control over siting of energy facilities, and there is no evidence that the utilities agency will ban such facilities. The question is whether in siting energy facilities the agency will act in conformance with approved coastal zone and land-use plans.
The unified authority the State intends to use outside ABC's may not be sufficient. According to a State official, these regulations have an inherent weakness - a developer could comply with all of them and still be violating a coastal zone land-use plan. The official said the commission could not stop such a development.
....If significant areas of the coastal zones are included within ABC's, the impact will probably be slight; if not, this weakness could become serious.[3]

The BLM should thoroughly examine the relationship between present or proposed CZM plans for the South Atlantic states affected by OCS and the onshore impacts of OCS-related development. The land-use guidance required to cope effectively with such impacts should be implemented before development is induced, not after.

7. Oilspill Impact on North Carolina

Though no lease areas are directly off the coast of North Carolina, the oilspill probabilities shown on Figure 8, p. 198, indicate that

[3] The Coastal Zone Management Program: An Uncertain Future, U.S. General Accounting Office, GGD-76-107, December 10, 1976.

North Carolina coastal areas have over a 25% chance that an oilspill will reach them. The only other area with this high a probablity is the Florida coast north of Cape Canaveral.

Consequently, we are very concerned that adequate protection against oilspills is provided in all leases and is enforced effectively by the appropriate authorities such as the U.S. Coast Guard. In addition, adequate equipment and personnel should be available in the Southeast Atlantic to cope with the inevitable emergencies that would occur with any intensive OCS development.

8. Onshore Impacts on Drinking Water Supplies

Section V, J, 2, the onshore environmental impacts of the proposed sale on water quality, fails to discuss a problem that many areas of the country are facing, drinking water quality and quantity. Water quality is not just concern for water pollution but also the provision of adequate supplies of potable water.

The environmental statement should address both the primary and secondary impacts of onshore OCS-related development on the drinking water supplies of the areas impacted. Specifically, the following should be discussed:

- impact on known aquifers,
- effect of project on salt water intrusion in coastal aquifers,
- onshore effects of development on existing water supplies,
- capability of existing water systems to supply needed water, and,
- impacts of near-shore spills on area water supplies.

9. Employment

Section III,E,3,A discusses onshore impacts of the proposed sale relative to employment in the region. We would caution, however, that the "increase" in employed workers that is often given as a positive impact of

OCS development is transient and not permanent. In addition it is subject to fluctuations depending on the particular stage of OCS development.

The BLM should compare the employment generated by OCS development with that generated by conservation efforts that would save as much net energy as might be produced from the South Atlantic OCS. See the previous Section 2 relative to the employment gensrated by large-scale conservation efforts.

10. Office of Technology Assessments Review of OCS Issue and Options

In November 1976, the U.S. Congressional Office of Technology Assessment published a study of the various coastal impacts of offshore systems such as OCS oil and gas. The study identified the following key issues and options relative to OCS oil and gas leasing:

Issue 1: Future deployment of ocean technologies on a large scale could create serious conflicts among users and impose excessive burdens on ocean and coastal environments unless a system for setting priorities of use and for zoning ocean areas, such as land areas now are zoned, is established.

Issue 2: Federal management of the offshore oil and gas program is fragmented within the Department of the Interior and coordination with other Federal agencies which share jurisdiction is ineffective.

Issue 3: Inadequate regulation and enforcement of offshore oil and gas technology could result in more accidents and more oil spills than would occur if a more effective system were implemented.

Issue 4: Existing laws are not adequate either to assign liability or to compensate individuals or institutions for damages from oil spills resulting from exploration, development, or production in the Baltimore Canyon Trough (or South Atlantic) area.

Issue 5: There is no assurance that the technology utilized in the Baltimore Canyon Trough or in any other OCS frontier region would be adequate for oil spill surveillance, containment, and cleanup.

Issue 6: Environmental research and baseline studies are not formally coordinated with the Interior Department's leasing schedule and there is no requirement that information gathered be used in the decision-making process for sale of offshore lands and subsequent operation.

Issue 7: The limited role of State governments in the decision-making process for OCS development under existing laws and practices may lead to unnecessary delays and improper planning for such development.

Issue 8: The effects of pollutants which may be discharged during OCS operations cannot presently be determined with any accuracy and recent research efforts have not clarified conflicting claims by oil companies and environmental groups regarding the amount and consequencies of marine pollution.[4]

We feel the BLM should respond to each of these issues relative to the South Atlantic OCS Sale No. 43. Specific questions relative to these issues raised by the Office of Technology Assessment:

- Will the sale conflict with other ocean uses? If so, to what extent?
- What more effective modes of coordination of Federal management of OCS are possible?
- Are regulation and enforcement of oilspills adequate based on other OCS experiences?
- How will liability and responsibility for OCS-related development that cause damages such as these from oilspills be assigned?
- Is the existing technology available to provide adequate oil spill containment and cleanup?
- Why is leasing occurring before all baseline studies have been completed?
- How will the States be intergrated into all phases of OCS planning and subsequent development?
- How accurately can the negative impacts of OCS operations on the marine environment be predicted?

[4] Coastal Effects of Onshore Energy Systems, United States Congress, Office of Technology Assessment, U.S. Government Printing Office, Washington, D.C., November 1976.

We appreciate the opportunity to respond to the Draft EIS on this proposed OCS sale. In the future we would welcome solicitation of our comments on a pre-draft rather than a published draft, if appropriate.

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092

OFFICE OF THE DIRECTOR

In Reply Refer To:
Mail Stop 760

APR 14 1977

Memorandum

To: Director, Bureau of Land Management

Through: Assistant Secretary--Energy and Minerals

From: Director, Geological Survey

Subject: Review of draft environmental statement for OCS Sale No. 43, Offshore the South Atlantic States

We have reviewed the subject draft environmental statement as requested in your memorandum of February 11.

Page II-23: The draft statement does not recognize presently occurring land subsidence or future increases in subsidence rates as a result of ground-water withdrawals, although it stresses the reliance on ground water of many of the larger coastal cities. A close correlation between pumpage, decline of artesian head, and subsidence has been observed, for example, in the Savannah, Georgia area (Poland, J. F., and Davis, G. H., 1969, Land subsidence due to the withdrawal of fluids: Geological Society of America Reviews in Engineering Geology II, p. 230 and 231). This aspect of past and future development of the south Atlantic coastal areas should be recognized because of the increasing importance of ground-water resources resulting from both population growth and industrial development.

Page IV-17, Stipulation 1: We do not object to the interpreted bathymetric map as a means of delineating "live" bottom areas. However, we believe that the lessee should be informed, prior to leasing, of possible operating restrictions in hard bank areas. There is considerable disagreement regarding operating restrictions around banks in the Gulf of Mexico. Some of the restrictions proposed for the Gulf could, if applied in the South Atlantic, prohibit or modify operations significantly in large portions of the leasing areas. If the intent of this stipulation is to provide a basis for further operating requirements, the possible restrictions should be outlined.

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DIVISION OF MINERALS
ENVIRONMENTAL ASSESSMENT

Page IV-17, Stipulation 3: We do not believe the ordnance survey requirements should be broadly applied to the entire leasing area. All OCS areas pose some unexploded ordnance hazard; however, because of the minimal risks involved, special surveys have not normally been required. We recommend that the proposed survey requirements only be applied to areas with known hazards.

Page IV-18, Stipulation 5: Some new barges are designed specifically for offshore transport and harsh weather conditions. We recommend that the stipulations be modified so as not to exclude the use of such barges

Page IV-20, section E4: The last paragraph should be changed to read: "High resolution subbottom profile data that will disclose bottom and subsurface conditions posing special environmental hazards for drilling or production operations in the U. S. South Atlantic offshore area will be reviewed by the U. S. Geological Survey prior to the decision to issue a lease and prior to the approval of drilling operations."

Page V-5, section J2: Measures should be considered to minimize secondary adverse effects on onshore water quality resulting from runoff from new construction sites.

Acting Director

SINCE NINETEEN-HUNDRED "THE VOICE OF CONSERVATION"

April 15, 1977

RECEIVED
APR 19 1977
DIVISION OF MINERALS
ENVIRONMENTAL ASSESSMENT

Mr. Curt Barklund
Bureau of Land Management
Dept. of the Interior
Washington, D.C. 20240

Dear Mr. Barklund:

The purpose of this letter is to offer comments on behalf of the Florida Audubon Society upon the Draft Environmental Impact Statement for the proposed 1977 Outer Continental Shelf Oil and Gas Lease Sale - South Atlantic OCS Sale No. 43.

An area of particular concern to the Society is the map on page III-21 of the draft EIS, which shows the relative probability of an oil spill coming ashore on different parts of the coast. We observe that the northern part of the Florida Atlantic coast alone, from Cape Canaveral to the Georgia line, has a 43% chance of being impacted by a given oilspill in the South Atlantic lease area, and that during the life of the offshore oil fields (assuming they indeed exist) there is no less than 74% chance of Florida being so impacted. Since we are dealing with an event that is much more likely to happen than not, we need to be a great deal better prepared for such a contingency than we are now. We also need to evaluate how best to reduce this 74% to a more acceptable figure by means of more thorough spill prevention techniques.

A major flaw in the wording of the draft EIS was the implicit assumption in any discussion of costs and benefits that there is indeed oil to be found in the South Atlantic OCS. The industry's experience in the MAFLA area should underscore the importance of caution in any such generalizations. Exploration of the Sale 43 area carries a major cost in terms of irretrievable commitment of fuel and other resources, as well as environmental damage to a degree that is not yet accurately quantifiable, and may well result in no discoveries of producable hydrocarbons. In other words, the costs are certainties and the benefits only possibilities, and while this is not an argument against oil drilling per se, it should be recognized that this is the nature of the enterprise in the EIS.

At this time, the Atlantic coastal states are working on their coastal zone management plans. None has yet been completed and approved by the Office of Coastal Zone Management. Even the exploratory phase of oil drilling in the South Atlantic

921 Lake Sybelia Drive • P. O. Drawer 7 • Maitland, Florida 32751
(305) 647-2615

arsa would require aome coaatsl construction, and if oil ia found in quantity, dacisions will have to be made quickly on where to bring it sahore. We feel it is vital to tha integrity and spirit of the Cosstal Zona Manaqament Act that Sala No. 43 not taka placa until aach of the South Atlantic coastal atatss has completad ita manaqament plan. This delsy would also provide time for improving the atate of ths srt of oil cleanup tachniques.

While we are not party to tha bandwagon that insiats on breakup of the oil companies or formation of a Federal agency to produce domestic oil, we are keenly awara of the need for astabliahing a procedure for allowing appropriate intervals betwean tha axplorstory phaae and the production phass of oil extraction. We feel thet it ia indeed desirable to know if thare sra worthwhile oil reservea in the South Atlantic area to allow the country to implement an enargy policy thet incorporstea the beat svailable information on domeatic reaarvea, but production of that oil should wait until it is most naedad and careful deciaiona heva been made in the coastal stataa on how to bring it aahore. Now is the time when the entirs OCS laasing procadura ahould be carafully anslyzad and new procedures selected thet will protect the environment bettar and allow our hydrocarbon resourcaa to be produced ss part of a long-term enargy atrategy rather than aimply sa an effort to lesaan the need for strenuous enargy conservation on the part of all citizans. csrefully considered federsl involvement in oil explorstion appeara to be an eaaantisl part of such a plan; if explorstion were done by the oil industry on contract to the faderal government, with sll findings monitored by the USGS and placed in the public domain, the economic pressaure to produce tha oil immedistaly would be eliminsted and the monay bid by the companiaa for tha aventual production of tha oil would bear aome relstion to the value of the tracts for which they were bidding.

Sincerely,

Peter C. H. Pritchard, Ph.D.
Vica Presidant - Sciance & Reaearch

rd

COLUMBIA GAS SYSTEM SERVICE CORPORATION

April 12, 1977

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Apr 18 9 39 AM '77
[illegible]

Mr. John L. Rankin, Manager
New Orleans Outer Continental Shelf Office
Bureau of Land Management
Hale Boggs Federal Building, Suite 841
New Orleans, Louisiana 70130

Dear Mr. Rankin:

The Columbia Gas System was represented bv an observer at the recent (March 31 and April 1) hearings on South Atlantic OCS leasing held at Charleston, South Carolina. Although we had not planned to present or file a statement in connection with this particular lease sale, further reflection on some of the comments offered there prompts this submission for the record and your attention in accordance with the hearing notice as oublished in the Federal Register dated February 16, 1977.

After participation in and/or observance of a number of these field hearings we have become increasingly concerned over the tendency of some witnesses (usually those opposed to or urging delay in the leasing process) to imply that once a lease sale is conducted and leases issued there is no further recourse from uncontrolled drilling and development. As anyone who is familiar with OCS procedures, including those who act as professional protectors of environmental valuea, must be aware, this is simply not the case. The lease sale is only the beginning of a long, tortuous and expensive series of permits, licenses, approvals, inspections and other forms of governmental supervision that must be traversed st each step of the development and production process.

We are reasonably certain, for example, that the hearing panel of departmental officials that received the testimony on OCS Sale No. 43 would not be misled by this kind of semi-hvsteria, nor would those who will ultimately decide whether to proceed with the leasing. Yet, the genersl public can be swaved by it and even some otherwise knowledgeable journalists and Federal judges aopear to accept it uncritically. This does a distinct disservice to the careful and extensive measures undertaken by the Department of Interior and other Federal and state agencies to aasure the integrity of the coastal environment

In this connection, we commend the effort reflected in Chapter IV-A of the South Atlantic DEIS to enumerate the various forms of continuing supervision which remain available. However, that discussion is preaented in the context of mitigating measures available to minimize or offset adverse environmental impacts We respectfully submit that this formidable body of continuing Federal involvement is deserving of separate and more prominent treatment which will emphasize the fact that the lease sale is not the laat and irretrievable step that totally divests the government of ita control over the tracts involved. The subject is an integral part of the institutional structure for leasing rather than a true mitigating factor and, as such, would be more effectively presented immediately following the leasing proposal deacription in Chapter I of the DEIS. If presented in this fashion, the public and the press may be educated as to the true scope and effect of a decision to proceed with leasing. Perhapa more significantly, proponents of delay until every minute aspect of OCS environment is fully cataloged can be challenged to demonstrate how the lease sale can have the cataclyamic reaulta they predict in the light of aubsequent requirements which muat be met.

In urging that the DEIS place separate and heightened emphaaia on post-leasing permit, certificate, inapection and other requirements, we would not want to be understood as favoring or aupporting the present situation with respect to thoae impedimenta to prompt develooment They are in a very major degree overlapping and duplicative, time consuming and

costly, as witnesses for API and EXXON demonstrated so sharply in their testimony. While this may not be the best forum in which to do so, I will use this opportunity to urge again that strong efforts be made in conjunctioq with all affected agencies to streamline the permit and approval process and thus reduce the time span and cost of lease development. However, since the existence of multiple and redundant controls is a present fact of life, it should certainly be used to apprise the public of the full range of protective measures that remain available

Thank you for this opportunity to submit our written comments in the light of some statements presented to the hearings.

Sincerely,

Robert W Welch, Jr.

RWWJr/pch

United States Department of the Interior

BUREAU OF OUTDOOR RECREATION
WASHINGTON, D.C. 20240

IN REPLY REFER TO:
DES 77/6

APR 19 1977

Memorandum

To: Director, Bureau of Land Management (732)

From: Acting Director, Bureau of Outdoor Recreation

Subject: Review of Draft Environmental Statement for Proposed 1977 Outer Continental Shelf Oil and Gas Lease Sale Offshore the South Atlantic Coasts

We have reviewed the draft statement in accordance with your February 11, 1977, memorandum and find it to be excellent in its consideration of impacts upon the recreation resources and activities in the area. In addition, we wish to commend your agency for the excellent graphics depicting recreation sites.

for Mary Lou Grier

RECEIVED
APR 1977
DIVISION OF ENVIRONMENTAL

STATE OF FLORIDA

Department of Administration

Division of State Planning

660 Apalachee Parkway 1BM Building

TALLAHASSEE
32304
(904) 488-2401

R.G. Whittle, Jr.
STATE PLANNING DIRECTOR

Reubin O'D. Askew
GOVERNOR

Lt. Gov. J. H. "Jim" Williams
SECRETARY OF ADMINISTRATION

April 14, 1977

APR 27 2 30 PM '77

Mr. John L. Rankin, Manager
New Orleans O.C.S. Office
Bureau of Land Management
Hale Boggs Federal Building
500 Camp Street, Suite 841
New Orleans, Louisiana 70130

Dear Mr. Rankin:

Functioning as the state planning and development clearinghouse contemplated in the U. S. Office of Management and Budget Circular A-95, we have reviewed the following draft environmental impact statement:

Proposed 1977 Outer Continental Shelf Oil and Gas Lease Sale, South Atlantic O.C.S. Sale No. 43, Volumes I and II, SAI 77-2239E.

During our review, we referred the environmental impact statement to the following agencies, which we identified as interested:

Department of Commerce
Department of Community Affairs
Department of Environmental Regulation
Department of General Services
Department of Legal Affairs
Department of Natural Resources
Department of State
Department of Transportation.

Agencies were requested to review the statement and comment on possible effects that actions contemplated could have on matters of their concern. Letters of comment on the statement are enclosed from:

Department of Commerce
Department of Legal Affairs
Department of Natural Resources.

This agency, having reviewed the documents and comments submitted by the above state departments, plus our participation at the public hearing in Savannah, Georgia, concludes that the State of Florida would support the timely development of Outer

Continental Shelf energy resources, provided that adequate protection is given to our environmental quality. We are not opposed to the exploration of oil and gas in the South Atlantic at this time; however, we find the environmental impact statement deficient regarding the analysis of effects that may occur in the production phases of the proposed program. A complete analysis of the environmental and related socio-economic impacts is required, plus detailed site analysis, as deemed necessary. These analyses should be part of a supplemental environmental impact statement for the various phases of the program. The supplemental statements could be prepared prior to and during the exploration phase. They should be prepared, based upon the following:

1. Necessary base-line studies and establishment of a continuing monitoring program (note Bureau of Land Management Environmental Studies Advisory Committee, Jamison Resolution),

2. More accurate estimates of the amount and location of oil and gas,

3. Improved coordination between the coastal states and federal government,

4. A meaningful involvement in the decision-making process by the affected states during the exploration and development program, and

5. A National Energy Policy that provides overall guidance for the program.

We believe that when the above-stated objectives are accomplished, the State of Florida can consider an endorsement for full development and production of the South Atlanta Outer Continental Shelf's oil and gas resources.

In accordance with the Council on Environmental Quality guidelines concerning the statement on proposed federal actions affecting the environment, as required by the National Environmental Policy Act of 1969, and the U. S. Office of Management and Budget Circular A-95, this letter, with attachments, should be appended to the final environmental impact statement on this project. Comments regarding this statement and project contained herein or attached hereto should be addressed in the statement.

We request that you forward us copies of the final environmental impact statement prepared on this project. We appreciate the opportunity to comment on these documents.

Sincerely,

R. G. Whittle, Jr.
Director

RGWjr/Ke

Enclosures

cc: Mr. Thomas Harris, Department of Legal Affairs
Mr. Jack Kane, Department of General Services
Mr. Joseph W. Landers, Jr., Department of Environmental Regulation
Mr. W. N. Lofroos, Department of Transportation
Mr. Loring Lovell, Division of State Planning
Mr. William Ravenell, Department of Community Affairs
Mr. Harmon Shields, Department of Natural Resources
Dr. Robert Smith, State University System of Florida Institute of Oceanography
Mr. E. J. Trombetta, Department of Commerce
Mr. H. E. Wallace, Game and Fresh Water Fish Commission
Mr. Robert Williams, Department of State
Mr. Ken Woodburn, Office of the Governor
Mr. Walter O. Kolb

STATE OF FLORIDA

Department of Administration

Division of State Planning

660 Apalachee Parkway IBM Building

TALLAHASSEE

32304

(904) 488-2371

Reubin O'D. Askew
Governor

R.G. Whittle, Jr.
STATE PLANNING DIRECTOR

Lt. Gov. J. H. "Jim" Williams
SECRETARY OF ADMINISTRATION

DIVISION OF STATE PLANNING
Bureau Of Intergovernmental Relations
MAR 8 1977
RECEIVED
SAI NO.

TO: Mr. William Ravanel, Sec.
Dept. of Community Affairs
2571 Ex. Center Circle East
Tallahassee, Fla 32301

DATE: 2-23-77

DUE DATE: 3-18-77

FROM: Bureau of Intergovernmental Relations

SUBJECT: SAI: 77-2239E

Please review and comment to us on the above draft Environmental Impact Statement, copy attached. In reviewing the statement, you should consider possible effects that actions contemplated could have on matters of concern to your agency.

If you feel that a conference is needed for discussion of the project or resolution of conflicts, or if you have questions concerning the statement, please call Mr. Walt Kolb at (904) 488-2401. Please check the appropriate box below, attach any comments on your agency's stationery and return to this office or telephone "no adverse comments" by the above due date.

On that date, we intend to consider all review comments received and develop a state position on the project. In both telephone conversation and written correspondence, please refer to the above SAI number.

Sincerely,

Loring Lovell, Chief
Bureau of Intergovernmental Relations

Enclosure

TO: Bureau of Intergovernmental Relations

FROM:

SUBJECT: DEIS Review and Comments 77-2239E

☒ No Comments ☐ Comments Attached

Signature: Peter F Bromell Administrator Date: 3/4/77

Title: Local Assistance Section

STATE OF FLORIDA

Department of Administration

Division of State Planning

660 Apalachee Parkway IBM Building

TALLAHASSEE

32304

(904) 488-2371

Reubin O'D. Askew
Governor

R.G. Whittle, Jr.
STATE PLANNING DIRECTOR

Lt. Gov. J. H. "Jim" Williams
SECRETARY OF ADMINISTRATION

TO: Department of Legal Affairs
The Capitol
Tallahassee, Fla. 32304

DATE: 2-23-77

DUE DATE: 3-18-77

FROM: Bureau of Intergovernmental Relations

SUBJECT: SAI: 77-2239E

Please review and comment to us on the above draft Environmental Impact Statement, copy attached. In reviewing the statement, you should consider possible effects that actions contemplated could have on matters of concern to your agency.

If you feel that a conference is needed for discussion of the project or resolution of conflicts, or if you have questions concerning the statement, please call Mr. Walt Kolb at (904) 488-2401. Please check the appropriate box below, attach any comments on your agency's stationery and return to this office or telephone "no adverse comments" by the above due date.

On that date, we intend to consider all review comments received and develop a state position on the project. In both telephone conversation and written correspondence, please refer to the above SAI number.

Sincerely,

Loring Lovell, Chief
Bureau of Intergovernmental Relations

Enclosure

TO: Bureau of Intergovernmental Relations

FROM:

SUBJECT: DEIS Review and Comments -2239E

☐ No Comments ☒ Comments Attached

Signature: Thomas A Harris Date: Apr 13, 1977

Title: Asst. A.G.

ROBERT L. SHEVIN
Attorney General

STATE OF FLORIDA
DEPARTMENT OF LEGAL AFFAIRS
OFFICE OF THE ATTORNEY GENERAL
THE CAPITOL
TALLAHASSEE, FLORIDA 32304

April 13, 1977

Manager
New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
500 Camp Street - Suite 841
New Orleans, Louisiana 70130

Re: DEIS for the OCS Sale No. 43

Dear Sir:

This letter comprises my comments upon the Draft Environmental Impact Statement (DEIS) on the proposed 1977 Outer Continental Shelf Oil and Gas Lease Sale in the South Atlantic (OCS Sale No. 43). I hope that you will receive these comments as constructive criticism and attempt to take necessary corrective measures before the Final Environmental Impact Statement is issued.

I should like to begin by making an overall comment as to the tenor of the DEIS. The Department of Interior seems to have accepted as a foregone conclusion that the proposed lease sales should and will occur regardless of the resulting adverse environmental impacts. By assuming this attitude the Department has proposed OCS Sale No. 43 before being in an adequate position to assess the environmental impacts which might occur from such sale.

Specifically, my point is that without knowledge of what amount and at what location oil and gas is present on the Outer Continental Shelf, it is impossible to adequately analyze the environmental and economic impact of producing and transporting that oil and gas. Without a knowledge of the amount and location of the oil and gas, it is not possible to state what will be involved in its production or transportation. It is likewise impossible to engage in more than mere conjecture as to what the adverse environmental consequences

of the OCS Sale No. 43 might be. It is further not possible to make any analysis of the steps which could be taken in mitigation of the adverse environmental impact.

The DEIS is replete with examples of the inability to analyze risks of environmental harm due to lack of knowledge about oil and gas resources available. For example, in I.C.1 it is stated that it is too conjectural to predict at the present time the positioning and landfalls for pipelines. It is stated in I.C.2 that while the scope and nature of development attending this lease sale can be anticipated in part, the scenario of development anticipated could vary "when it becomes more clear what resource potential exists and where it is located." Furthermore, in III.A.7 it is unabashedly admitted that it is not possible with any degree of certainty to indicate the location of future facilities which may result from the proposed lease sale.

The difficulty of trying to evaluate the environmental impact of this project without adequate knowledge of the amount and location of the resources to be produced and transported is further exemplified by the attempted analysis of the environmental impact of the proposed lease sale on wetlands and estuaries. While the DEIS gives generally adequate descriptions of the ecology of wetlands and estuaries, the analysis of the impact of the project on those sensitive areas is very short and wholly inadequate. I suggest to you that the reason for this inadequacy is because it is not known, for example, where pipelines will be laid and, hence, what wetlands and estuaries will be affected.

In order to cure the general incompetency of the DEIS as pointed out above, further consideration should be given to the alternative of taking no action to lease the Outer Continental Shelf at the present, but to determine the amount and location of oil and gas first and then produce the plan to exploit such resources affording public comment on same.

It is meritorious that the DEIS does discuss the alternative of government exploratory drilling prior to leasing in VIII.D.1. The discussion of this alternative, however, inadequately explains its advantages in providing a specific means of determining what environmental impacts will occur from the project and what steps may be taken to mitigate them.

Furthermore, ignored completely is the alternative of permitting private industries to explore for oil and gas prior to the leasing of any OCS tracts. This could be done in a method currently used

by the Department of the Interior in the mineral leasing of other federally-owned land. Specifically, oil companies would be issued prospecting permits for specified areas of the Outer Continental Shelf. Should a permittee discover valuable deposits on one or more of the tracts for which he holds a prospecting permit, it would receive the right to be preferred, that is, it would be given first choice, if the decision to lease those tracts were made. Under this alternative, the Department of the Interior would know where and what amount oil and gas occur prior to making the decision to lease. The Department could then more precisely predict how and where the oil and gas would be produced and transported. It could also more realistically determine the environmental impacts of these activities and how those impacts could best be mitigated.

Another means of determining the amount of oil and gas present and then developing a separate plan for production subject to public review would be to simply grant the lease sale along with the right to production but require such production to be subject to the review and approval of the Department via an environmental impact statement with public comment. In other words, although production rights would be guaranteed, the Department could require that production be done per an approved plan in the least environmentally destructive manner.

I am sure you are aware of the recent decision of Judge Weinberg in County of Suffolk v. Secretary of the Interior, Case No. 75-C-208, U.S.D.C. for the Eastern District of New York. In that case Judge Weinberg was reviewing the adequacy of the Final Environmental Impact Statement for the North Atlantic OCS Lease Slae. In his opinion, Judge Weinberg stated that the environmental impact statement must be site specific, that is, must consider the specific conditions in the sale and the actual environmental effects of exploration and development resulting from the sale, as well as the reasonable alternatives. In the context of the South Atlantic OCS Sale, it is clear that such an analysis can only be done after more is known about the amount and location of the resources to be developed.

In addition to the general comment about the DEIS which I have made above, I have several specific comments to make about various portions of the DEIS. First, it is noted in I.C.3 that certain benchmark studies are being carried out by Texas Instruments, Inc. It has been brought to my attention that a study sponsored by the Council of Governors indicates that the DEIS benchmark studies were not properly planned. These studies apparently rely on sampling stations which were arbitrarily picked and which produced data which is not representative of what is present in

the South Atlantic marine environment. It is imperative to have adequate base line data before beginning OCS oil and gas production in order to monitor the effect of these operations and to maintain proper management over them. I realize that this need for benchmark data is recognized by the Department of the Interior and is the reason why such studies are currently being done. I strongly urge, however, that before any leasing is done that the criticisms of the benchmark studies be assessed and, if necessary, that new and adequate benchmark studies be completed.

The DEIS further fails to fully discuss, evaluate and consider the impact of state and local regulatory powers on the transportation of the oil discovered. The DEIS assumes that there will be two pipelines transporting the oil to onshore facilities. The Department fails to predict the routes of these pipelines or their alternatives or the effect of local and state regulations on those routes. Certainly, local and state regulations will, to a large extent, determine what environment will be affected by the transportation of the oil and gas to the shore. While recitation is made in I.E.2 of the existence of local and state regulatory powers, such recitation is not enough to satisfy NEPA, which requires evaluation and consideration, and an estimate of the effects. The impact of these factors, and not just their existence, must be considered. The fact that there may be coastal zone management programs in the future is no excuse for the omission of this analysis from the DEIS. The Environmental Impact Statement for the North Atlantic Lease Sale has been found to be legally deficient for failure to include an adequate analysis of the effect of local regulations. County of Suffolk v. Secretary of the Interior, supra. The DEIS appears to suffer from the same legal deficiency.

As mentioned above, the DEIS contains an inadequate analysis of the impact of this project on the estuaries and wetlands. The impact is currently described only in gross generalities. A much more detailed and specific discussion of impact is needed in order to determine how these impacts might be mitigated. A detailed discussion of the steps for mitigation is also needed.

Section VIII, paragraph C discusses the alternative of withdrawal of the proposed sale, and relies on the OCS programmatic FES 75 (July 7, 1975) for a discussion and evaluation of energy actions and alternative sources which might be used as substitutes for the oil and gas which may result from the proposed leasing. This discussion and consideration of alternatives by reference to a document which was published in 1975 is inadequate for the

purposes of the present DEIS. There have been significant developments and discoveries in the energy field in the past two years which require updating of this 1975 report.

In closing, although at this time not opposing the exploration for and production of oil on the South Atlantic Outer Continental Shelf, I feel that before a commitment is made to production of oil in that area, we should know to the greatest degree possible what will be involved in that production, and what steps we might take in order to mitigate or avoid the resulting adverse environmental impacts. I do not believe, at the present time, that an adequate analysis of those factors can be made. Instead, it would be of the greatest benefit to the protection of the environment and still consistent with the goal of the speedy production of oil and gas in the Outer Continental Shelf Area, to make the first step of exploring and defining resources available on the Outer Continental Shelf. Once this has been done, proper assessment of environmental impact and steps to avoid or mitigage them will be possible.

Sincerely,

ROBERT L. SHEVIN
Attorney General

RLS/Hg

STATE OF FLORIDA
Department of Administration
Division of State Planning
660 Apalachee Parkway
TALLAHASSEE 32304
(904) 488-237

RECEIVED FEB 25 1977
DEPT. OF NATURAL RESOURCES

Reubin O'D. Askew
GOVERNOR

R.G Whittle, Jr
STATE PLANNING DIRECTOR

Lt. Gov. J. H. "Jim" Williams
SECRETARY OF ADMINISTRATION

EXECUTIVE DIRECTOR

TO: Mr. Harmon Shields, Ex. Dir.
Dept. of Natural Resources
Crown Building
Tallahassee, Fla. 32304

DATE: 2-23-77

DUE DATE: 3-18-77

FROM: Bureau of Intergovernmental Relatione

SUBJECT: SAI: 77-2239E

Please review and comment to us on the above dreft Environmental Impact Statement, copy attached. In reviewing the statement, you should conaider poeelble effecte that actione contemplated could have on mattere of concarn to your egency.

If you feal that a conference ie needed for diecuseion of tha project or reaolution of conflicta, or if you have queetions concerning the statement, pleaae call Mr. Walt Kolb at (904) 488-240I. Pleeae chack the eppropriate box below, ettach any comments on your agency'e etationery and return to thie office or telephone "no adverae commenta" by the above due data.

On that data, we intend to conaider all reviaw commenta received and develop e etata position on the project. In both telephone converaation and writtan correepondence, pleese refar to the above SAI number.

Sincerely,

Loring Lovell, Chief
Bureau of Intergovernmental Relationa

Enclosure

TO: Bureau of Intergovernmental Relatione

FROM: Department of Natural Resources

SUBJECT: DEIS Review and Commenta 77-2239E

☐ No Commente ☒ Comments Attached

Signature: James B. Smith Date: March 17, 1977

Title: Assistant to the Executive Director

State of Florida
DEPARTMENT OF NATURAL RESOURCES

INTEROFFICE MEMORANDUM

March 11, 1977

TO: Charles M. Sandars, Director
Division of Resource Management

FROM: Bruce Johnson, Chief
Bureau of Coastal Zone Planning BJ

RE: SAI 77-2239E

The staff of tha Bureau of Coastal Zone Planning has reviewed tha above referenced project and has the following comments:

1. On page II-156 Port Canaveral should have bean idantified as one of the larger ports in the study area since Canaveral has a controlling depth in excess of 38 feet.

2. On page IV-14 the santence reading "The Florida coast has almost continuous davelopment from the Jacksonville area south to Cape Canaveral" is absolutely incorrect. This statement conflicts with Section II(G)(8)(D) on pages II-219 through II-221 which accurately describes tha existing land use conditions along Florida's northeast coast.

3. The information providedby the "Notice of Support Activity for the Exploration, Development or Production Program" that is submitted to tha directly affected statas should be expanded to include:

   (a) Estimated watar and energy requirements for planned onshore OCS-related facilitias recognizing available resources at tha selected davalopment sites.

   (b) Projectad construction employment needs for these facilitias.

   (c) Projected schedules and timeframes for the construction and operation of the individual onshore facilitias giving special attantion to the phasing of the various facilities.

4. The provision that the "Notice of Support Activity for the Exploration, Development or Production Program" will be forwarded only to those states that have approved CZM plans should be revised to allow raview by thosa states that do not possess approved CZM plans. Consideration should be

given to anlarging the distributiom of the "Notice" to includa not only those states that peasess approved CZM plans but also those states that are making adequate prograss toward development of coastal plans. (States making adequata progress as used here is defined to mean those states that are receiving federal coastel management funds undar Section 305 of the CZM Act). This reviaion should obviate the need for selecting the extreme alternative of delaying the lease sale for three to five yeara.

5. A special stipulation adopting e period of amepension for offshore developent (up to six months in order to parallel the stata CZM certification process for federal consistency) between the exploretion phase and the development phase should be considered. Specifically, an interim certification program limited only to onshore OCS-ralated development and federal leases for offshore development and production should be established for those states with CZM plans and for those statas making adequate prograss toward plan approval. This requirement would provide coastal states with greater opportunity for input to and raview of proposed onshore devalopment plans. Moreover, an additional review period could possibly preclude subsequant delays in the development of onshore OCS-related facilities.

Thank you for the opportunity to comment.

BJ/rss

CC: Ray Siuta
Dan Penton
Darryl Segraves

DEPARTMENT OF STATE
Washington, D.C. 20520

BUREAU OF OCEANS AND INTERNATIONAL
ENVIRONMENTAL AND SCIENTIFIC AFFAIRS

April 18, 1977

Mr. Curt Berklund
Director, Bureau of Land Management
Room 5660
Department of the Interior
Washington, D.C. 20240

Dear Mr. Berklund:

Thank you for the opportunity provided to the Department to comment upon the Dreft Environmental Impact Statement on the Proposed 1977 Outer Continental Shelf Dil and Gas Lease Sale, prepared by the Bureau of Land Menagement.

The Department of Stata notes that the possibility of impacts from the proposed lease sale on the islands of the Bahamas has not been addressed. It is racognized that the distance between the southernmost boundary of the area and the Bahamas is perhaps several hundred miles. Nevertheless, a massive blow-out, or more likely, the increased tanker traffic moving from the area into the Caribbean, might affect the Bahamas. Accordingly, we would suggest thet a specific reference to the Bahamas be included in the Draft even if only to acknowledge that there is such a remote possibility of impacts that these are not considered to be of significant potential consequence.

Sincerely,
Donald R. King
Director
Office of Environmental Affairs

RECEIVED
... 12 1977
Department of ... Affairs
ENVIRONMENTAL ASSESSMENT

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

April 20, 1977

Manager, New Orleans Outer Continental
Shelf Oil Office
Building of Land Management
Hale Boggs Federal Building
500 Camp Street, Suite 841
New Orleans, Louisiana 70130

RECEIVED
APR 25 9 39 AM '77
... REGIONAL ...

Dear Sir:

This is in reference to your draft environmental impact statement entitled "Proposed Outer Continental Shelf Oil and Gas Lease Sale, South Atlantic OCS Sale No. 43." The enclosed comments from the National Oceanic and Atmospheric Administretion are forwarded for your consideretion.

Thank you for giving us an opportunity to provide these comments, which we hope will be of essistance tn you. We would appraciate receiving twelve (12) copies of the final statement.

Sincarely,

Sidney R. Galler
Deputy Assistent Secretary
for Envirnnmental Affairs

Enclnsuras - (1) Memo, National Ocaan Survey, March 22, 1977
(2) Memo, Environmental Data Sarvice, April 4, 1977
(3) Memo, Natinnel Marine Fisheries Service, April 15, 1977
(4) Memo, National Weather Service, April 18, 1977
(5) Memo, Environmental Rasearch Laboratnries, April 12, 1977

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SURVEY
Rockville Md 20852

C52/JLR

MAR 2 - 1977

MAR 18 1977

TO: William Aron
Director
Office of Ecology and Environmental Conservation

FROM: Gordon Lill
Deputy Director
National Ocean Survey

SUBJECT: OEIS #7702.40 - Proposed 1977 Outer Continental Shelf Oil and Gas Lease Sale South Atlantic OCS Sale

The subject statement has been reviewed within the areas of NOS responsibility and expertise, and in terms of the impact of the proposed action on NOS activities and projects.

The following comment is offered for your consideration.

The data contained in Subsection 5, "Tides and Tidal Currents," and 7, "Sea Level Variations," are correct and properly interpreted. The remaining subsections have been evaluated in terms of the references used and conclusions. The section on physical oceanography is extremely thorough and detailed. The figures and graphs are also sufficient for direct application to an environmental assessment of any specific area.

APR 27 8 38 AM '77

Top speeds appear to usually be between 100 and 200 m.p.h. and are seldom greater than 250 m.p.h.

For additional oceanographic information, contact the National Oceanographic Data Center, NOAA, Washington, D.C. 20235.

For additional climatological information contact the National Climatic Center, Asheville, North Carolina 28801.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
ENVIRONMENTAL DATA SERVICE
Washington, D.C. 20235

April 4, 1977

APR 4 1977

TO: William Aron, Director
Office of Ecology and Environmental Conservation, EE

FROM: Douglas LeCompte
Special Projects

SUBJECT: EDS Review of OEIS 7702.40 - Proposed 1977 Outer Continental Shelf Oil and Gas Lease Sale South Atlantic OCS Sale

Physical Oceanography

General Comment

Much of the oceanographic data described are based on the 1953-54 GILL Cruises. These data are unrepresentative of oceanographic conditions. Many additional sources are currently available and BLM should make use of them before the final EIS is issued.

Specific Comments

Page II-44, (5), fourth paragraph: Change "1.5m(1.2ft)" to read "0.4m(1.2ft)".

Page II-54, B: Change "draft bottle" to "drift bottle".

Page III-6,2: Last paragraph starting "impacts to..." is not supported and is, in fact, contradictory to previous statements in the text, notably on page II-28 under section B, Karst topography.

Page III-7, third paragraph: Does this paragraph deal with the alternative of semi-submersible rigs being used, as opposed to the bottom-supported structure (jack-up rig)? It is not clear, and the advantages/disadvantages of this alternative could prove interesting. Appendix C provides a description of drilling methods but is inserted for information purposes only and not tailored to this situation.

Climatology

Specific Comments

Page II-91, 7 second paragraph, second sentence: Change "southeast to northwest" to "southwest to northeast."

Page II-91, 7 third paragraph, second sentence: Recent studies indicate wind speeds within tornadoes are not as great as previously suspected.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Duval Building
9450 Gandy Boulevard
St. Petersburg, FL 33702

APR 15 1977

April 8, 1977

FSE61/

TO: Director
Ofc of Ecology & Environmental Cons, EE

APR 15 1977

THRU: for Acting Assistant Director for
Scientific & Technical Services, F5

FROM: William H. Stevenson
Regional Director

SUBJECT: Comments on Draft Environmental Impact Statement - Proposed 1977 OCS Oil and Gas Lease Sale, South Atlantic OCS Sale No. 43 (DOI) (DEIS #7702.40)

The draft environmental impact statement for South Atlantic OCS Sale No. 43 that accompanied your memorandum of February 22, 1977, has been received by the National Marine Fisheries Service for review and comment.

The statement has been reviewed and the following comments are offered for your consideration.

General Comments:

The DEIS lacks the necessary information on fishery resources and habitats of the Outer Continental Shelf for us to assess the impact of the proposed action on these resources. Also, safeguards to protect "live" bottom areas and associated marine organisms should be specifically detailed in special stipulations which ensure that the National Marine Fisheries Service (NMFS) will be consulted before any drilling, exploration, or production activity is approved in these areas.

Specific Comments:

VOLUME I
II. DESCRIPTION OF THE ENVIRONMENT
E. Biological Communities
2. Coastal and Onshore
c. Endangered Species
Sea Turtles, page II-128. We suggest that this section note that the loggerhead (Caretta caretta) and the green sea

turtle (Chelonia mydas) are proposed to be listed as "threatened" by both the NMFS and the Fish and Wildlife Service. Moreover, these species were recently relisted as endangered (November 1976) by the Convention on International Trade in Endangered Species of Wild Fauna and Flora.[1]

North of the Florida-Georgia line, nesting is mostly by loggerheads. The most aggregate nesting takes place at Cape Romain Wildlife Refuge in South Carolina, and on Cumberland and Jekyl Islands in Georgia.[2] Loggerhead nesting also occurs in Brevard County, Florida, which in 1976 recorded the highest number of marine turtle nestings in the State.[2] We suggest that these locations be included on the visuals.

G. Human Utilization

5. Commercial Fishery Resource, pages II-180 - II-193. In line with the information in this section on king mackerel, we also note that this species is a sought-after sportfish and recent data indicate that it undergoes wide ranging migration through the lease area.[3] These migrations are shown in Figure 1.

III. ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

B. Offshore Impacts of Oil and Gas Operations on the Natural Environment

3. Impacts on Benthos

Page III - 48, paragraph 3. According to the OEIS, "...structures, drilling, and the disposal of muds and cuttings will have a severe effect on the benthic organisms at the immediate site of these structures, wells, and disposals... . Steps will be taken to avoid such operations on 'hard banks' 'live banks', or 'fishing banks'." We recommend that the specific steps taken to avoid such operations on bottom features be fully described and that criteria also be developed for implementation of these steps.

O. Onshore Impact of Oil and Gas Operations on the Natural Environment

5. Endangered Species

Page III-70, paragraph 3. Although the statement acknowledges that a principal impact of oil washing ashore would be contamination of sea turtle eggs and hatchlings, other serious impacts on this group are stated to be a remote possibility. Since sea turtles nest from approximately the first week in May through September with hatchlings emerging after a 60-70 day incubation, a spill impacting a beach would affect sea turtles for up to seven months of the year. Moreover, the statement erroneously assumes that the only impact on hatchlings would occur when they emerge from nests on oil coated beaches. Sea turtles are air breathing animals and hatchlings swim continuously at the surface. Thus, a spill would undoubtedly affect them, as well as the forage items (small fishes and crustaceans) that make up the major portion of their diet.[1]

F. Summary of Matrix Analysis

Table F-1, d. Potential impacts on endangered species, page III-124. Regarding previous comments on oil spills affecting hatchling sea turtles, we submit that oil spills could have a moderate to maximum potential impact on this group. We further suggest that the statement point out that offshore structures could have a potential impact. Subadult sea turtles are positively phototropic and are strongly attracted to lighted areas such as baseball fields, condominiums, and fishing boats. Therefore, well-lighted platforms would similarly attract them, in which case, they would be highly susceptible to predation by gamefishes which the statement points out should occur in abundance nearby. In this regard, we suggest that the column on endangered species in Table F-2 (page III-126) be revised to accomodate this possibility.

IV. MITIGATING MEASURES IN THE PROPOSED ACTION

C. Mitigations Included for Specific Aspects of the Proposed Action

1. Offshore Structures and Pipelines

Page IV-14, paragraph 5. The sentence, "The FWS, with assistance from appropriate State and Federal agencies, including NMFS,..." should be rewritten to read, "The FWS, NMFS, EPA, and appropriate State agencies, now review..." Also, the last sentence, "When appropriate, the agency recommends to the Corps..." should read "When appropriate, these agencies recommend to the Corps..."

O. Special Stipulations

Page IV-17, Stipulation 1. We believe that this stipulation does not provide for the protection of "live" or hard bottom areas on the South Atlantic Outer Continental Shelf. In letters dated May 12 and September 21, 1976, the Regional Director, Southeast Region, NMFS provided comments and recommendations on the draft stipulations prepared by BLM. We still feel that firm criteria should be established to determine whether development will be allowed on "live" or hard bottom communities.

1/ Personal communication, Larry H. Ogren, Fishery Biologist, NMFS, Panama City Lab, Panama City, FL

2/ Carr, A.F. 1976. Survey and reconnaissance of existing shores and coastal habitats of marine turtles in southeastern United States, Puerto Rico and the Virgin Islands. NMFS Cont. Rep. No. 03-6-042-35129.

3/ Williams, R.O. 1976. King mackerel tagging and stock assessment study Rep. to Nat Mar Fish Serv, project No. 2-254-R, Com. Fish. Res. Dev. Act 52p.

In the case of pelagic and demersal fish, benthos, and other animals of commercial and recreational value, the Department of Commerce through the NMFS, not BLM or FWS, has a major responsibility for their protection and rational use. We, therefore, recommend that the Supervisor approve exploration and/or development plans only after ascertaining, through consultation with the Regional Director, Southeast Region, NMFS that there will be no significant adverse effects on recreational or commercial fishery resources or upon the biological and physical systems supporting these resources.

It is requested that one copy of the Final EIS be sent our Area Supervisor, NMFS, Environmental Assessment Division, P.O. Box 570, Beaufort, NC 28516, and Area Supervisor, NMFS, Environmental Assessment Division, P.O. Box 4218, Panama City, FL 32401.

Enclosures (3)

cc:
F53 (3)
FSE611
FSE612

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
Silver Spring, Md 20910

Wx2 APR 1 7

APR 18 1977

TO: William Aron
Director, Office of Ecology & Environmental Conservation

FROM: Vincent S. Murin
Chief, Executive Affairs Staff

SUBJECT: DEIS 7702.40 -- Proposed 1977 Outer Continental Shelf Oil and Gas Lease Sale South Atlantic OCS Sale No. 43

Attached are the National Weather Service's comments on the subject draft.

Attachment

Comments on the Draft of Environmental Impact Statement
OCS Lease Sale No. 43

by

Celso S. Barrientos, W427
National Weather Service
NOAA, Silver Spring, Md. 20910

This is a very big report. It covers a wide variety of topics. Thus, it is almost impossible for anybody to digest everything in it, especially during the short length of time for the review.

I can only comment on the following subjects:

(1) physical oceanography
(2) climatology
(3) oil spill trajectory

The discussions of the first two are rather shallow, the references used are old, and the presentations are not clearly tied-in with the report. Physical mechanisms of the various environmental phenomena, e.g. storm surge, tornado, are not explained clearly. I believe any mention of tornado or waterspouts should reference Fujita, Pearson, or Golden. When it comes to storm surge, I don't see how Platzman, Reid, Jelesnianski, and Freeman can be missed. As for "northeasters", works of Myers and Pore are quite significant. More input on the report could have come from EDS and NWS. Apparently it did not, since National Weather Service was even missed in page IX-1.

Storm surge will be an important factor on the four states considered here. Climatology of storm surges has been processed in relation to the Flood Insurance program. Return periods (probabilities) of surges along the coast have been computed. I believe this report should utilize this information. The report is very recent and has information that is very recent, e.g., the ARGO MERCHANT oil spill is already included. However, there is information used that is old and has been improved or superseded.

With regards to the oil spill trajectory, it appeared that the MIT model is the ultimate. I disagree in this regard. The most important part of the MIT model is the wind factor (3.5% of the surface wind speed). This wind factor approach is still not convincing and conclusive. More importantly, the MIT model approach doesn't take into consideration how the wind is obtained. In both operational mode or risk assessment procedures, we should determine first the quality of the wind forcings before the trajectory computations. Our results are strongly dependent on how good is our meteorology. An oil spill trajectory model is only as good as the wind data input, and to a lesser extent the atmospheric stability.

Comments on Draft EIS on Proposed OCS Oil and Gas Lease Sale

by

K. W. Ness

In Topic B, Oil and/or Gas Well Blowouts, in Heading 4, Probability of Oil Spills in the U.S. South Atlantic Region, Section III, Pg. III-9, it is estimated that an "average" blowout would be approximately 1053 to 3159 barrels, based on 20 years of Gulf of Mexico drilling. First, is there any reason why Pacific Coast statistics should be ignored? Although some climatological differences exist, as they do between the Gulf of Mexico and the south Atlantic, drilling procedures should be comparable. Second, the "average" spill ignores one giant spill of more than 2,000,000 gallons which could have considerably more than average impact, especially since the spill may have more than a 50% chance of reaching shore in spring or summer (p. 185).

In Section IV, Mitigating Measures in the Proposed Action, Proposed OCS Order No. 12 (Pg. IV-5) provides that certain data on the drilling operation will be available to the public, but other data withheld. It is not clear whether specific properties of the petroleum will be made available to better facilitate identification of spilled oil. Also, under Special Stipulations, Pg. IV-17, it is not clear whether the drilling companies are subject to legal action for property damage due to spilled oil incurred by coastal communities and their residents. This type of legal responsibility would be desirable.

In Section VIII, Alternatives to Proposed Action a slight reference is made to energy conservation as an alternative course of action (Pg. VIII-12). This alternative should be more fully discussed within the body of the EIS. It is asserted that any delay in production of OCS oil adversely affect human health but health aspects of using any oil and natural gas must also be weighed. It is admitted (on Pg. III-73) that some air quality will deteriorate due to OCS oil use. The assumption is made that overall air quality will increase because auto emission standards will be made more stringent, but progress in upgrading these standards may not be fast enough to counter pollution due to OCS oil and gas use. Finally, estimates of total energy from leased drilling land are given, but no comparison is made with total U.S. energy production, regional production and use, or amounts which could be saved by alternatives such as conservation.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
ENVIRONMENTAL RESEARCH LABORATORIES
Atlantic Oceanographic & Meteorological Labs
15 Rickenbacker Causeway
Miami, Florida 33149

RF20-326-9(a)5

APR 12 '77

April 5, 1977

TO: William Aron, Director, EE

FROM: Harris B. Stewart, Jr., Director, AOML

SUBJ: DEIS 7702.40, OCS Lease Sale, Atlantic

I have reviewed the DEIS (7702.40) and find it adequate for the purpose for which it is intended. On page 1 of Section IX, the term is National Weather Service (Vice Bureau), and this correction should be made.

Harris B. Stewart, Jr.

State of South Carolina

JAMES B EDWARDS
GOVERNOR

OFFICE OF THE GOVERNOR
POST OFFICE BOX 11450
COLUMBIA 29211

April 19, 1977

The Honorable Cecil Andrus
Secretary of the Interior
Washington, D. C. 20240

Dear Mr. Secretary:

In accordance with the request of your Department, I am enclosing herewith comments which have been compiled by my office in response to the Draft Environmental Impact Statement (EIS) regarding the proposed South Atlantic OCS Lease Sale Number 43.

These comments are intended to be constructive and either to correct or supplement the information contained in the draft EIS or to point out areas for which additional information is considered essential. They represent a concensus of various state agencies and academic departments involved in the several aspects of the projected OCS development.

I would like to re-affirm the position of my office that the lease sale described in this EIS should proceed on schedule. Our state, as well as the nation, has critical energy requirements. In particular, we require natural gas in support of our textile industry. We have suffered increased unemployment as a result of energy shortages. We are firmly convinced that OCS development should proceed without further delay, and that such development can be accomplished with reasonable care of the natural environment and with minimum social turbulance.

The review of the EIS has emphasized our belief that much valuable information can be obtained, as a by-product of oil exploration, which is needed to identify biological and archaeological data. Specifically, the alternative survey techniques described in Section VIII-18-20 of the EIS cannot only assist us in the discovery of potential fishing grounds and archaeological finds, but also will tend to safeguard areas concerned from possible damage. We therefore recommend that the survey discussed in Section VIII-18-20 be required.

I wish to emphasize that the State of South Carolina, together with county and municipal government institutions, are in a good position to carry on the planning and programming functions concomitant to the exploration and development of the OCS. We are one of the few coastal states with an on-going Marine Resources Research Center and its programs.

We have continuing studies which will determine best locetions for such fecilities es pipe lines, pumping stetions and naturel ges processing. Ws likewiss, through such state agencies as the Water Resources Commission, Oepartment of Heelth end Environmental Control, and the State Ports Authority ere in e position to guide and assist our county and city governmants end planning egencies to prepare for the socio-economic impect of any oil discovery.

Finelly, I would like to invite your ettention to the specific recommendations contained in Sections IV, O end E of the draft EIS. In ceses involving stats comments with respect to lsase stipulations, reports and development plans, I believe the governors must have direct, formal eccess to your office in event his recommendetions are not given affirmative consideretion by the U. S. Geologicel Survey supervisor. I can conceivs of such a need only in the cese of most significant and criticel impact upon the netural environment or upon the socio-economic stetus of the community. I trust you will understand the need for state consultation with either you or your immediate staff under such circumstances.

May I take this occesion to wish you the greetest success during your administration of ths Department of the Intsrior.

With wermest personel regards,

James B. Edwards

JBE/tbe

Enclosures

cc: Mr. John Rankin

ONSHORE/NEARSHORE ENVIRONMENTAL

COMMITTEE REPORT

Chairman: G. Ed Richardson

The following agencies are represented in the Onshore/Nearshore Environmental Committee: S.C.Water Resources Commission, S.C. Wildlife and Marine Resources Department, S.C. Department of Health and Environmental Control and S.C. Land Resources Conservation Commission.*

Committee members generally expressed the desirability to continue planning to develop the hydrocarbon resources on the Outer Continental Shelf in an expeditious manner provided proper environmental safeguards are enacted.

The comments and suggestions developed by the Committee are intended to be constructive, either to correct or supplement the information contained in the Draft Environmental Impact Statement, or to point out areas for which additional information is considered essential.

Specific comments and suggestions regarding the Draft Environmental Impact Statement are as follows:

*Major participants in the formulation of these comments include: G. Ed Richardson, S.C. Water Resources Commission; Henry Fulmer and Roger Mudd, S.C. Land Resources Conservation Commission; James Timmerman, Wayne Beam, Vic Burrell,Jr., S.C. Wildlife and Marine Resources Department; Charles R. Jeter and Cliff Hawkins, S.C. Department of Health and Environmental Control, and John Califf, S.C. Department of Archives and History.

SECTION I

1. An Executive summary of the Draft Environmental Impact Statement would be most helpful to provide a more succinct statement of the salient facts and findings. In the event this is not possible, each section contained within the narrative of the Draft Environmental Impact Statement should be followed with a synoptic review and summary of those major points contained within the section.

2. The use of visuals in Volume 2 of the Draft EIS is most useful to depict environmental data to the non-technicrat.

3. On page I-3, section B.1 - the State of South Carolina met with representatives of BLM and the U.S.G.S. during the tract selection process to assist in the evaluation of specific tracts for inclusion in the recommendations for consideration by the Secretary of the Interior. Numerous tracts were added to the proposed sale tracts which had not been discussed with State officials. This type of action tends to disrupt the working rapport and confidence State officials have with regional representatives of the federal government.

4. On page I-3, section C.1 - a diagram of the Summary of Activities Expected to Result from the Proposed Sale would be most helpful. A chronological chart depicting the inter-actions, overlaps and, most importantly, onshore service support functions for each segment would improve the understanding for the reader.

5. On page I-3, section C.1 - Tanker shipment of the hydrocarbon resources in the South Atlantic OCS is environmentally less palatable to the State than shipment via pipeline. Recent tanker tragedies reinforce statistics presented by Porricelli & Keith (1973) that tankers represent a greater environmental risk to release hydrocarbons into the ocean than do pipelines. The State is most apprehensive of petroleum movements via relatively small tankers which may not have the sophisticated navigation equipment necessary to preclude incidents which would release petroleum in environmentally sensitive areas.

6. Page I-3, section C.1 - Concurrent use of oil and gas lines in pipeline corridors is most desirable in selected areas as designated by the State.

7. Page I-6,section C.3 - The BLM's environmental studies program should be integrated more effectively in the formulations of the Draft EIS and in other leasing decisions contemplated by the Department of the Interior. This is especially important in the current Benchmark Studies programs.

8. On page I-7, section C.3 - Department of the Interior representatives should examine the OCS Environmental Studies Advisory Committee's Review and Evaluation Subcommittee Final Report regarding the BLM's Developing South Atlantic Environmental Study. Or. Dirk Frankenberg, Chairman, from the University of North Carolina Marine Science Program at Chapel Hill details RFP discrepancies with objectives of the BLM Study Plan.

9. On page I-7, section C.3 - Care must be taken in Benchmark Studies to avoid situations from developing as those with the SUSIO group during the MAFLA Studies. Data gaps in information particularly in Benchmark Studies must not occur. Oiscontinuity in seasonal samplings may render previously collected environmental data useless for benchmark evaluations.

10. Page I-7, section C.3 - State officials, especially OCS Environmental Studies Advisory Committee members, should be invited and encouraged to attend and participate in contractor's presentations to BLM. This should include progress reports and specific problems which might arise during the investigation.

11. Page I-7, section C.3 - Information necessary to predict impacts

on our "live bottom" areas by oil exploration and production is minimal. The Draft EIS lists BLM sponsored research but from this list, little interest is displayed toward fisheries. This causes the State some concern since sport and commercial fisheries are such an important economic resource. The primary efforts are concerned with chemical analyses of animals collected at very few locations on the shelf and with a geologic survey to determine bottom types without regard to the biological communities associated with them.

12. Page I-6&7, section I.C.3 - The State expresses concern over the availability of data that will be collected under the "Marine Environmental Study Plan for the South Atlantic OCS Area; Georgia Embayment and Blake Plateau Regions". It is understood that the data would not be available to our Environmental Control agency or any other agency concerned with OCS development until this data is archived in the National Oceanographic Data Center (NODC). Contractural agreements will not require Contractors to store data on the NODC computer until their contract expires which could result in as much as an 18 month time lag between the actual time the data is collected and the time State agencies would be able to review it. This does not allow the State to perform "near real time analysis". Further, these extended periods of unavailable data could require the State to duplicate sampling of off-shore waters which would seem to be a wasted expense.

It is recommended that all future contracts require the storage of raw data into the NODC computer as soon as it becomes available.

13. On page I-8, section C.3.A - The type of crude oil used will effect the composition of the microbial communities which will degrade the particular hydrocarbons. Since no oil has been produced off the South Atlantic OCS, care must be taken in selecting the crude oil or its fractions to be evaluated in degradation studies.

14. Page I-9, section C.3.A - Information on location, extent, and associated biota of "live bottom" is critically needed. These areas are the centers of off-shore recreational fisheries of South Carolina. A developing commercial fishery is heavily dependent upon these features on the shelf: knowledge of stocks, spawning and migration of reef fish, which is essential to predict impact of oil-related activities in these areas, is sorely lacking. Special studies may be necessary to address these points.

15. Page I-9, section C.3.A - A discussion of biological impacts of oil spills should be examined to include up-to-date information on the effects of recent spills, such as the Argo Merchant and Falmouth Bay spills on the marine biota.

16. Page I-10, section D - The State of South Carolina is most interested in the updating of the Proposed OCS Planning Schedule should such an occasion arise. This will allow the State the opportunity to judiciously allocate our resources to ensure proper and environmentally safe development of the South Atlantic OCS hydrocarbon resources, and related onshore development.

17. Page I-14, section E.2 - The Federal Government must recognize development outside the three (3) mile limit may ultimately effect the adjacent State whether it may be in the form of onshore/nearshore development (including secondary development) or catastrophic events.

18. Page I-14, section E.2.A - The discussion of the Coastal Energy Impact Program as authorized by the Coastal Zone Management Act Amendments of 1976 is inadequate given the importance of this program for ameliorating potential on-shore activities.

19. Page I-14, section E.2.A - The discussion of the proposed OCS lease sale as it relates to the state's evolving coastal zone management

program is inadequate. This section indicates more interaction between the Department of Interior and the South Carolina Coastal Council is needed regarding the lease sale. The South Carolina Coastal Council has undertaken a number of projects which will be very beneficial to both the public and private sectors when considering possible on-shore activities. These include a bottom current study, a pipeline corridor study, building local government capability for addressing the expected on-shore activities, and evaluations of potential sites for heavy industry as well as environmentally sensitive areas. This information and other research activities, once completed, will be important elements of the state's coastal zone management program. These outputs when combined with the proposed legal authorities for the Council must be integral parts of any OCS development plan. South Carolina's Coastal Zone Management Program should be completed within a two year period but under the current schedule of OCS activities, most critical decisions will have been made. Therefore, we request more consideration of the Council's work products to date and more effective linkages with the evolving coastal zone management program.

Additionally, we do not find adequate consideration of certain hazardous areas (i.e. flood and erosion areas) as they are being identified by the National Flood Insurance Program.

20. Page I-15 - This section does not adequately address South Carolina's current legal authority and role in coastal zone management, especially concerning lands below the mean high water mark. At present, the State claims ownership of most of this property and the statement that all development controlled below mean high water in South Carolina is federal is not accurate.

21. Page I-15, section South Carolina - A State permit is also required by virtue of State ownership of lands below mean high water out to the three

(3) miles limit. (Issued by the Budget and Control Board). Note that comments are forwarded to the Corps of Engineers by notifying them a State permit has been granted. This action is coordinated by the S.C. Water Resources Commission. A State wildlife comment is also required by Corps of Engineers under federal law. (Fish and Wildlife Coordination Act requires this comment on certain federal actions by the head of the State wildlife organization.

SECTION II

1. Page II-3, Figure A-2 - Add legend to figure and reduce narrative for clarity.

2. Page II-8, section A.2 - As is noted in the text - "Growth on these banks appears sparse when the outcrops are covered with a thin layer of sediment..." care must be taken in the disposal of drilling muds and bore hole cuttings around live bottom areas to prevent deleterious results on this habitat. Lease stipulations would appear to be a method of precluding unnecessary sedimentation on the rocky outcrops.

3. Page II-B&9 - Information presented on these pages suggest much more study is necessary to delineate and evaluate the live bottom areas in the South Atlantic OCS area.

4. Page II-13, Figure A.10 - Remove sample location dots. This would allow the reader to more readily evaluate the basic trends of current and drift patterns. As the figure is presently depicted, it is extremely difficult to see the residual bottom drift arrows.

5. Page II-19, section B, Soils - USOA data on soil maps must be interpreted with care. Characteristically, relatively shallow soil samples are utilized in developing these maps and deeper geologic information may not be available for incorporation. This is particularly apparent in regards to suitability for construction of large structures on specific land types.

6. Page II -19 to 23, section B, Soils - Information on erosive potential of soils would be beneficial as construction activities onshore may result in excessive sedimentation in our waterways.

7. Page II, 23-25, section C, Hydrology - Only superficial information is incorporated into the Draft EIS regarding the basic hydrologic data and problems in South Carolina. The South Carolina Water Resources Commission currently

has several ground water programs underway which would provide information that would be most beneficial to the OEIS. This is a serious oversight in the Oraft EIS as potential hydrologic problems effect both the economic and environmental condition of the State of South Carolina.

8. Page II-41, section B, Physical Oceanography - Note: work is under way on a sea island study along the South Carolina and Georgia coastline which might be of assistance to you in this section. Please contact the S.C. Marine Resources Research Center in Charleston, S.C. for detail on the status of this work and the study objectives.

9. Page II-73, section B. Oceanographic data requirements section has a good narrative for delineating future study needs. Dther sections would also benefit from such an exercise.

10. Page 11-76, section C - The discussion on chemical oceanography seems rather brief in its description of the South Atlantic. More information, if available, should be incorporated in this section. If none may be found, section should state that this is a major data deficiency and recommend remedial action to fill this data gap. This entire section needs strengthening.

11. Page II-94, section E.1.A - Should river water come from upland areas used principally in agriculture, Thomas's conclusion of phosphate poor river waters may be subject to question. Combine this with erodible phosphate deposits in certain geologic formations and some questions should be re-examined. Other substance may be the growth limiting factor.

12. Page II-97, section E.1.A - Oraft states: "Information on coastal productivity throughout the region is inadequate and in need of further study". This may potentially be an area to evaluate for future special studies or recommendations to groups conducting research in this area to concentrate their activities to investigate some of the basic information needs.

13. Page II-113, section F Pelagic Birds - Both terns and pelicans have rookeries at the Cape Romain Migratory Bird Refuge (including Bulls Bay). Brown Pelicans referenced at Bulls Bay and Seabrook Island are located in South Carolina, not in Georgia as stated in the Oraft EIS. Other rookeries exist along S.C. coastal region. BLM should contact the S.C. Wildlife and Marine Resources group in Charleston, S.C. for delineation of these areas.

14. Page II-11S, section G. Biologically Sensitive Areas - The draft EIS states: "...little is known about the location, size and ecology of these live bottom areas". Special studies should be designed to ensure OCS operations will not unnecessarily disrupt these biologically sensitive areas. They are important economically to the majority of our sport fisheries industries and a developing commercial fishery associated with these "live bottom" areas.

15. Page II-116, section G - It is believed substantially more than 5% of the proposed lease tracts contain "live bottom" areas. However, until an adequate survey of the "live bottom" areas have been completed, the Draft EIS is merely dealing in conjecture.

16. Page II-128, section C, Sea Turtles - More information should be included in this section. The S.C. Wildlife and Marine Resources Department, has some reasonably good numbers on sea turtle populations and location along the S.C. coast. Certain sections of beach along the S.C. coast have large nesting grounds. Including North, South, Cedar, Murphy and Cape Islands.

17. Page II-13S (Mesohaline Systems) and Page II 139 (Oligohaline systems). Winyah Bay is cited as a mesohaline system and the Pee Dee River which empties in Winyah Bay is cited in the Oligohaline section. A review of the Oligohaline system is warranted. Winyah Bay occasionally stratifies when large flows are encountered in the Pee Dee system.

18. Page II-154 & 1SS, section 7 - Use of common terms is most confusing. Local populations may use one term for numerous plant species and another population may use the term to identify a totally different group of plants. Use of more scientific nomenclature is essential. One can only assume "cut grass" is referring to "white marsh". Many of S.C. rivers have fresh water marsh associated with them. These marshes are composed principally of white marsh (Zizaniopis miliacea) and as one moves toward more brackish water southern wild rice (Zizania aquatica) begins to appear prior to typical salt water vegetation (Spartina and Juncus, etc.). Typha species are also common in both fresh and salt water systems. Others include: Distichlis, S.patens, Salicornia, Scirpus and others.

19. Page II-156, section II-G - Hydrocarbon emissions from fuel storage to service the increase in ocean going vessels will develop. The increased tanker traffic will contribute particulates to the ambient air. This should be given a more detailed evaluation in the final EIS.

20. Page II-171, section G.1.B(6) - Airports section should consider data on availability of helicopters and associated facilities in the coastal zone (including helipad facilities). This may determine areas for certain secondary onshore development to support offshore activities. This is a most important deficiency.

21. Page II-193, section G.6 - Contact S.C. Wildlife and Marine Resources Department on Natural Areas. Several areas are under this program and are not discussed in this section.

22. Page II-206, section E(4). - Care should be taken with unknown cultural resources. In particular with the location of pipelines as the archaeological resource potential will increase as one moves closer to the shore and especially off major riverine systems.

23. Page II-21D, section 7 - Solid waste disposal in the Charleston area may be a problem as increases in population develop in this area as a consequence of OCS activities.

24. Page II-21D, section 7.B - The statement that tires are no longer being used for artificial reefs is not correct. The Marine Resources Division is still using tires extensively for the construction of fishing reefs.

25. Page II-216, section 8.B - Note: Research activities by Clemson University and USC at Belle Baruch Institute on Waccamaw Neck near Georgetown.

26. Page II-217, section 8.B - Note: Tourism is important to South Carolina in the Charleston area as well as along other areas on S.C. coast with many beautiful garden and old plantation estates. Historical areas such as Drayton Hall and others have National significants.

27. Page II-222, section H.1 - TKN stands for total kjeldahl nitrogen not "total all killed nitrogen".

28. Page II-222, section H.1 - The S.C. Department of Health and Environmental Control administers programs such that any onshore development with a wastewater discharge would have to comply with national standards of performance for new point source discharges which must also comply with State/Federal water quality standards. Various programs and permitting activities, including the National Pollutant Discharge Elimination System permit program, have been delegated to this Agency by the Environmental Protection Agency. The NPDES program with its subsequent controls would apply to all types of onshore development to include any processing facilities or other types of secondary development. Further, DHEC must certify all projects that require Federal licenses or permits to insure consistence with certain provisions of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500). This certification would again insure proper control technology and achievement of water quality standards within State waters. Activities covered by this certification include dredging and

filling in the tidelands areas and the construction of various structures within State territorial waters. Certain critical areas of concern such as open shellfish harvesting areas would be subject to special protection.

29. Page II-227, section H.3 - The description of South Carolina's basins is inadequate. To our knowledge the Morgan River does not show "severe contravension of water quality standards", as it is still classified as SA. The Combahee and Coosaw Rivers are also SA streams to the best of our knowledge.

30. Page II-227, section H.3 - Reference is made to this section concerning the degradated water quality in Segments 03-09-20 and 03-08-14. For up-to-date information, the City of Beaufort is no longer discharging raw sewage but has a secondary wastewater treatment system, and Charleston Harbor is generally meeting water quality standards.

31. Page II-227, section H.3 - Besides the occasional occurrence of spills, the major impact of oil and gas development on water quality will be associated with the transport and refining of the extracted petroleum on or near the shore. The environmental pressures associated with almost every aspect of secondary development will require additional expenditures of state and local resources in order to maintain water quality consistent with established water uses.

32. Page II-227, section H.3 - There does not appear to be any consideration given to the long term effects of urban development sprawl that always brings concomitant closure of shellfish growing waters. This is due to the inherent run-off induced by concrete and asphalt and natural gravitational flow of surface water to estuarine waters.

33. Page II-227, section H.3 - Note the Yadkin-Pee Dee River Basin extends into South Carolina as well as North Carolina and covers a critical area in South Carolina (tourism in Grand Strand area).

34. Page II-228, section H.3 - More substitive information should be

available on water quality classifications by sub-basins for South Carolina. Contact Department of Health and Environmental Control.

35. Page II-237, section I - Utilization of AQCR data may be compiled using mostly urban survey data and may not adequately protray the air pollution emissions problems of a particular region.

36. Page II-237, section I - In accordance with Air Pollution Control Regulations and Standards for the State of South Carolina, DHEC's Bureau of Air Quality Control conducts a permitting program for facilities which may discharge an air contaminant to the atmosphere within South Carolina. Also, under EPA delegation of authority, the Bureau of Air Quality Control reviews and enforces the Prevention of Significant Deterioration(PSD) and the new Source Performance Standards (NSPS) programs within S.C.. The above regulations, collectively, should be sufficient to insure that the construction of onshore facilities associated either directly or indirectly with activity on the outer continental shelf will not adversely affect the ambient air quality. However, it is important to note that the construction of any facility which emits air contaminants may have to secure emission trade-offs from existing facilities prior to approval to construct the new facility.

37. Page II-246, Figure 1-2, - This figure is difficult to read and should be re-drafted or modified to increase readibility. As is, the reader finds this figure so difficult to evaluate that we question its usefulness.

38. Page II-252, section J.1 - The construction of a petroleum refinery or a gas processing facility will attract other industries related to the petroleum industry (inorganic chemical plants, etc.). These other plants may not be affected directly by PSD and NSPS regulations, but they may have particulate, organic, SO_2, or odorous emissions that could adversely affect the air quality of the coastal region. Each facility, refinery or related facility, will add

to the particulate levels in the air from the attendent transportation emissions and fugitive dust generated by the facility. This should be given a more detailed evaluation in the final EIS.

39. Page II-252, section J. - There is evidence that the ambient air levels of oxidents in South Carolina are currently above the primary ambient air levels. It is felt that this condition exists generally over the entire state and exists especially around urban areas. Therefore, any facilities constructed onshore will have to consider the impact of their hydrocarbon emissions on the ambient air to reduce the oxidant contribution. The facility may have to secure emission "trade-offs" prior to construction of a source that will have hydrocarbon emissions. This was not sufficiently addressed in the draft EIS.

40. Page II-264, section B - Horry County - not - Harry County is in the Waccamaw Regional Council of Governments.

41. Page II-264, section B - Note: The formation of the Coastal Plans Regional Commission in the five State area (South Atlantic) to increase economic development in the coastal plains of these states.

42. Page II-266, section B - Charleston has only a limited amount of wharf space available (under present constraints) to support OCS operations without developing conflicts and competition for wharf facilities. Expansion should be planned in the Charleston and possibly the Georgetown areas to handle land-based OCS operations.

43. Page II-280, section 2. OBERS projections data do not take into account many economic, environmental and political decisions since 1972. Reservations should be used in these data when extrapolating projections.

SECTION III

1. Page III-1, A.1.B - Proper care must be taken during drilling operations to preserve the integrity of freshwater aquifers and to preclude the introduction of oil, sea or formation waters (of lesser quality) from reaching these important water resources. The sheer distance offshore may provide sufficient assurances that potentially, no fresh water systems in the locale of proposed leasing area, exist.

2. Page III-6, seciton A.2 - A special study is warranted to delineate hard bottom areas and to assess their environmental sensitivity. Lease stipulations should also be enacted for consideration and protection of these live bottom areas. Note: hard bottoms are disruptive benthos. While "Live Bottoms" are the biological communities associated with the hard bottom areas.

3. Page III-6, section A.2 - Adequate attention has not been given to the sand waves that are mentioned in Section III.A.2. The existence of these large sand waves are well documented in the literature. It is thought by some researchers that these large sand waves move during intense storms and remain inactive between storms. The location of offshore installations in areas where these bottom features are periodically mobile would be hazardous.

4. Page III-9 and 11, section 4 - A chart showing projections of oil spills for the South Atlantic would be worthwhile inserting in this narrative section. This is more useful than Table A-4, on page III-10. (Note: Page III 14 is a summary table for S.Atlantic hypothetical tanker spills).

5. Page III-11, section A.4.0. - The information on tanker accidents should be updated to include data through 1976. The statement misleads the reader since mention is made of the Argo Merchant accident in December 1976, but the data used to draw conclusions is for years prior to 1974.

6. Page III-16, section E. - CEQ data, to my knowledge, has no verfication on estimates of natural phenomena damaging offshore structures. Exercise caution when utilizing this data! Several events must occur simultaneously to produce a spill under CEQ's projections, plus failure of the sub-surface safety valves (0.96 probability of reliability). These conditions seem unrealistically severe.

7. Page III-19, section 5.- Neither the MIT nor DOI oil spill models consider the effect of "weathering"(including other degradation and evaporation) or dispersion. They also are based on no clean up attempts. These are major oversites in these models. Models should utilize "spills of opportunity" for varification, when possible.

8. Page III-24, Figure A-5. - Garrett, 1972 is not a bibliography. Check data and reference material. However, Figure A-5 is an outstanding schematic.

9. Page III-36, section E - Platform fabrication. The reference to LNG tanks and fabrication of these items should include a discussion of the C8I plant proposed in 8eaufort County. Also, the option of a major oil company on a parcel of property in coastal South Carolina (Jasper County) for possible construction of an oil refinery has not been discussed.

10. Page III-38, section 8.A. - Experience gained from Sale # 43 can provide the State with valuable planning data for subsequent sales in the South Atlantic OCS area, if the information is provided in a timely manner. Therefore, future problems may be eliminated.

11. Page III-44, section 8. - If necessary, shunting to the bottom may be utilized to minimize adverse impacts on phytoplankton, zooplankton and nearby live bottom areas. Other control measures and methods should also be examined if environmental conditions necessitate such actions.

12. Page III-47,section 8.3 - 8enthos. There is some discussion concerning disposal piles and recolonization of these piles by marine species. Are the disposal piles recolonized by the same species that were initially eliminated by burial or are these recolonizing animals perhaps opportunistic species? The results of research studies concerning the effects of fluid chemicals on marine biota should be included in the final EIS if available.

13. Page III-508, section 7. - Fish communities are also associated with hard bottoms and a reference to the section and impacts on nekton should be made or the potential problems addressed in this section.

14. Page III-53, section 9. - Check temperature figures of lighter fractions for evaporation. 4827°?

15. Page III-62, section 7. - Proposed lease stipulations do not require the use of a magnetometer or other specific equipment to determine impacts on offshore cultural resources. These surveys may be particularly valuable when pipelines come onshore due to more shallow water and a greater potential for cultural resources sites.

16. Page III-63, section 7. - A cultural resources survey stipulation is needed to protect this resource as is proposed on page VIII-19 & 20.

17. Page III-64, section 0.1 - "Two-four pipelines..." should read, "Two to four pipelines...".

18. Page III-64, section 0.2 - Wetlands. Proper planning on the State's part through designated pipeline corridors may minimize the impacts to our wetlands by pipeline construction. Most assuredly, the "push" or "shove" method is more desireable with its accompanying lesser environmental impacts.

19. Page III-65, section 0.3 - Vegetation - Coastal Zone Management programs should be involved in siting of support facilities and secondary development with large support from local communities.

20. Page III-70, section 0.5. - Studies by the S.C. Wildlife and Marine Resources Department will help identify sea turtle nesting areas and activities.

21. Page III-70, section 0.5. - The EIS lists numerous wildlife species which have suffered and died due to the effects of such proposed action. Several endangered species are listed among these but the entire category of migratory waterfowl seems to have been omitted.

22. Page III-70, section 6. - "SEAS model indicates....nutrient nitrate and phosphate would increase less than six during the peak years..." less than six what?

23. Page III-71, section 7. - Climatological conditions will affect air quality. These should be addressed in this discussion.

24. Page III-72, section 7. - Incomplete sentence in listing cities (second paragraph) "Charleston, S.C.; Savannah...".

25. Page III-77 - Subsection 0 states that impacts on vegetation overall will be slight and short-term. We agree with this position. The land use impacts shown in Table E-3, page III-77, appear to be minimal.

26. Page III-79, Section Secondary Land Use Impacts - The key to reducing secondary land use impacts is through careful State and local planning. Unfortunately insufficient information is available until discoveries are confirmed to provide some perspective for proper definative planning. Here lies the major problem.

27. Page III-80, section 3. - Care must be taken when interpreting and extrapolating data from the Harris Economic Model. Actual operations may or may not follow these relatively few scenarios. Use of rigid assumptions may tend to overstate probable impacts. See Socio-Economic sub-committee report.

28. Page III-80, section 3.A(3) - "....total increase in number of employed civilian persons range from 1.79 to 4.38." More narrative is needed. What are 1.79 and 4.38? Are these percentages?

29. Page III-89, section 3.B. - The possibility exist that Georgetown County may have some of the spin-off development from offshore oil and gas operations. It is approximately 20 miles less distance from the center of the highest interest area off South Carolina than is Charleston. Water depths in Georgetown harbor and additional wharf space may be advantages to the Georgetown area as well as the shorter distance to the offshore operations.

30. Page III-89 & 98, section 3.B. - Explanation of why a negative effect on Williamsburg County in South Carolina should be offered in the Final EIS. Are there circumstances which could minimize these impacts?

31. Page III-114, section 6. - Note: oil spill models assume there will be no clean-up activities in the event of a spill. This seems a bit unrealistic in assessing impacts on the shoreline.

32. Page III-114, section 6. - Regardless of the probability of oil spilled and its reaching a recreational beach, the season in which this event takes place will greatly affect the economic and environmental impacts suffered by the area (partially addressed on page III-116).

33. Page III-117, section 7. - Offshore platforms may serve as artificial reefs. They may possibly increase populations or may only serve as accumulation points for the fisheries resources providing additional protection and food sources.

34. Page III-123 to 126. - Recapitulation of Matrix Analysis tables is an outstanding effort.

SECTION IV

1. Page IV-1, section A.1.B. - Proper review of the USGS OCS Operating Orders cannot be made until all Orders have been published in the Federal Register. (Draft OCS Orders 1,2,3,4,5,7 and 12 appear in Federal Register). We, therefore, reserve comments on these Orders and this portion of the Draft EIS until all OCS Orders are available for review.

2. Page IV-11, section B.2. - OHEC's present oil spill capabilities for inland spills, due to transportation accidents, pipeline leaks and other point sources, are adequate. The method of detection is notification by the spiller and anyone else that observes a spill. There are limitations to the above methods of detection and we may want to pursue some other method such as an oil sensor or detector. Installation of these early warning devices at fixed locations would greatly enhance the overall reporting of spills. In addition, OHEC has developed, distributed and implemented a State Contingency Plan for oil spills.

For offshore spills, we have been depending upon the U.S. Coast Guard to investigate the incident and keep us informed on the action being taken and on the possibility of the spill reaching shore. OHEC is continuing to develop and revise Contingency Plans to meet the total demands of off, on and nearshore spills.

The question of liability and compensation for any oil spill incident is of concern and should be given a more detailed evaluation.

3. Page IV-12, section 3. - Most assuredly the South Atlantic States would like to see Clean Atlantic Associates establish a base in the South Atlantic area, possibly in Charleston, South Carolina.

4. Page IV-13, B.5 and Appendix G, p. 6 - Throughout the Environmental

Impact Statement, the results of an "Oil Spill Risk Analysis" are quoted by giving oil spill trajectories, time of travel, weathering rates, etc., however, the Oil Spill Contingency Plan does not incorporate the use of this model. The containment and clean-up of an oil spill could be enhanced through utilization of a remote terminal to provide variables necessary to determine the course of an oil slick. Information presented on oil spill trajectories suggests that certain environmentally sensitive or economically valuable stretches of coastline have a high probability of being impacted by an oil spill (Reference Section III.A.5). In view of the potential hazard from an oil spill, it is suggested that the lease holding companies provide spill handling equipment and trained personnel for clean-up operations.

5. Page IV-16, section O. Special Stipulations. These stipulations are inadequate in certain areas to protect the South Atlantic OCS region. We strongly urge developing special stipulations based on recommendations on page VIII-18 to VIII-20 for the following areas; (1) Biological Survey, (2) Cultural Resource Survey, and (3) Ordance Survey. These should be incorporated with those lease stipulations on page IV-17 and 18. Other considerations should be addressed as well.

6. Page IV-16 and 17, section O. - Drill cuttings and mud should be disposed of in such a manner as not to disrupe the communities inhabiting "live bottoms" in the vacinity of drilling activities. Placing of drill rigs directly over live bottoms should be prohibited.

7. Page IV-16 and 17, section O. - The leasee agrees to make every reasonable effort to preserve and protect the natural resources from damage until the supervisor has given directions as to its dispositions. This statement from the EIS is questioned as to its adequacy for protection of an archeaological

site. Is temporary suspension of operation until the supervisor can give directons too strong a possible option to be inserted?

8. Page IV-16 and 17, section O. - What constitutes "privileged information" on anything other than oil and gas resources and locations data? Why should lessee notices to South Atlantic States Governor's offices not also be subject to approval or disapproval by the supervisor? Is 30 days sufficient time for the Governor's office to have to review and comment on the notice of support activity for the expiration program by the lessee? Do such comments bear any real legal weight? Page IV-9, in explanation, states only that "the supervisor, in acting on an expiration plan, will take into account the comments of the State.

9. Page IV-16 and 17, section O. - Proper planning and siting of pipelines and on-shore facilities is critical to minimize the environmental impact of oil and gas resource development ôt sensitive estuarine areas, like tidal marshes and sea bird rookeries.

10. Page IV-16 and 17, section O. - Pipelines should follow breaks in primary sand dunes to avoid unnecessary alteration of this habitat. Revegetation should be undertaken in affected dunes to stabilize these areas against erosion.

11. Page IV-16 and 17, section O. - Ditches created by "push and shove" technique should be back filled after the pipeline is laid. In this way, marsh productivity will be restored through recolonization of affected areas by marsh plants. This method is preferred over the floatation canal technique, which entails considerably more alteration and disturbance of marshlands. In the event that floatation canals are necessary, these canals should also be back filled after pipeline installation. Since additional backfill material is usually required to complete back filling of these canals, perhaps the dredge materials derived from the Corps of Engineer dredging projects could be utilized. Also, when crossing

rivers or open bodies of water, pipelines should be jetted into place wherever possible. Where marsh buggies are necessary, their use should be restricted to established transportation lanes in marsh lands.

12. Page IV-16 amd 17, section D. - Dn-shore facilities, such as refineries, pipelines and roads should be given high priority in developed areas rather than impacting previously undeveloped regions. Vegetation destroyed along corridors during pipeline installation should be replanted immediately thereafter to help control soil erosion.

13. Page IV, 16 and 17, section D. - Brown Pelican rookeries, Bald Eagle nesting areas, and shore bird and wading bird nesting areas should be avoided in the selection of pipeline corridors.

SECTION V

1. Page V-2 and 3, sections E, F & G. - This section recognizes some adverse environmental impacts to beaches and wetlands, to vegetation and wildlife. However, these impacts are a risk we take for this resource development and the impacts will not be too severe. We believe this will be especially true if the gas and oil lines are brought on-shore at planned corridors.

We respectfully suggest that planned corridores be explored and used to the maximum extent possible. This would help reduce the number of locations where adverse environmental impacts would occur on-shore. It would also have its affect on land use impacts.

ADDITIDNAL COMMENTS

The S.C. Wildlife and Marine Resources Department finds the following omissions and suggests they be taken into consideration in the final EIS.

a) misidentification of the most important commercial species of shrimp by scientific names;

b) omitting organisms such as they bay Anchovy Mitchilli, from the discussion of oligohaline systems;

c) omission of the most important sea turtle nesting sites including North, South, Cedar, Murphy and Cape Islands;

d) omission of information on bird habitat such as that of the Southern Bald Eagle, Dsprey and Pelican;

e) omission of discussion on species considered by the State of South Carolina to be threatented or endangered.

MARINE ENVIRONMENT COMMITTEE

Chairman: Victor G. Burrell, Jr.

The following entitiae are represented in the Marine Environment Committee: Marine Resources Research Institute, Clemson Univereity, College of Charleston and individuals from the University of South Carolina.*

The Marine Environment Committee comente and suggestions deal primarily with topic outeide the nearehore/onshore area. However, specific phenomena are addressed where neceeeary ae natural syetems may transcend artificial boundaries.

Comments offered in thie committee not only addrees points for clarification in the Draft EIS but additionally suggeet future studies neceesary to portray adequately environmental conditione within the lease area.

Major comments and suggestions regarding the Draft Environmental Impact Statement by thie committee are ae follows:

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*Major participante in the formulation of these comente include: Victor G. Burrell, Jr., S. C. Wildlife & Marine Resourcee Department; A. E. Schwartz, Clemson University; Harry Freeman, College of Charleeton; Dick Zingmark & John Vernberg (ae individuals) from Univereity of South Carolina.

1. Page I-7, section C.3 - It is very evident from reading the EIS that the compilers sre aware, ss we are, thst information necessary to predict impect on our "live bottom" areas by oil exploration snd production is minimal. Further, as they list BLM sponsored research (page I-7) little interest in fisheries is evident. Their chief efforts ere concerned with chemicsl snslyses of animals collected at very few locations on the shelf snd with a geologic survey to determine bottom types without regsrd to biological communities sssocisted with them.

2. Page 1-6 to I-9, section C.3. - "The environmental studies program for the South Atlantic OCS is designed to acquire three distinct types of dats: benchmark, descriptive and predictive." (I-6) However, the snvironmentsl stndy plan outlined by the Department of the Interior (I-6 to I-9), does not include provisions to obtsin predictive information on the biological effects of stress levels imposed by oil snd gas development.

3. Page 1-7, section C.3. - On psge I-7 the third psragraph, the implicstion is thst the recommendstions of the conference/workshop were followed by BLM in developing future studies. Dr. Bruce C. Coull, who was involved in the development of the workshop's recommendations, has indicated to me thst this is not the csse. Many recommendstions were not followed.

4. Page 1-7 to I-9, section C.3. - I question whether reliable benchmark dsts on tha biological component of the environment can be obtained based only on four biological seasons. It is better than nothing, but I feel few biologists could testify in court whether observed changes in community structure were due to long-term nstural fluctuations or to man-induced perturbations. It is ironic

snd are of great economic benefit to the people in the coastal states. I hope that we cen convince the Department of Interior to recommend and fund the necessary research to gather the necessary dats thst will serve as e sound bssis for determining the impact of gas and oil production off our coast.

9. Page II - 104 to 108. - The section on benthos is not complete. The various works of Coull and Tietjgan sre not citsd.

10. Pege 11 - 128, section C. - The most important sea turtle nesting sites sre not recognizad in the visuals; these include North, South, Ceder, Murphy snd Cape Islands.

11. Page 11 - 128, section C. - Much recent information on bird habitat such as Southern Bsld Eagle nesting sreas, osprey nesting sites, snd Pelican losfing eress is svailable, but not included.

12. Paga I1 - 128, section C. - Endsngered and threstened species discussed sra only those on Pederal liats, snd Stste species ss such era not treated.

13. Page 1I - 145. There are severel errors which again indicate some lack of appreciation of the biots of sres by the compilers of the EIS. Examples include: misidentification of the most important commerciel species of shrimp by scientific names.

14. Psga 11 - 176, section 3. - Recently EPA publishad s revision of the ocean dumping regulatione. Although these regulstions were primarily for specific ocesn dump sites, they could have implicstions to the present EIS. BLM should examine the EPA regulations in respect to this possible interaction.

that e major reason for having an EIS is to analyze tha affects of proposed environmental changes on living organisms, but limited studies ere plsnned on the biotic component of tha anvironment.

5. Paga II-94, Paragraph 2, last sentenca: It implias hera that tha speciae listed on Tebla E-1 ara tha only "abundant" species of phytoplankton in S.E. shelf watars. In fact, the tabla shows speciss collected only in January 1968....at the time of tha year when spacias abundance and diversity are at their lowest.

6. Table E-1: No dinoflagallatas wara listed as "sbundant", yat latar (II-94, paragraph 6) it is mentioned that dinoflagelattes were present in all seasons and dominated tha shalf flore in the summer.

7. Page II-94, Paragraph 7: It is steted thet productivity studias in coastal waters are "limited" snd diverse deta era prasented to stress this point. Later on paga III-45, using date from these "limited" studies, the conclusion is made that the production phase of offshora oil devalopment will hava no significant advarsa impact on the production of offshore phytoplankton. How can one justify this stete-ment on the basis of "limited" data?

8. Paga II-94, section E.I.A. - Phytoplankton era the most significant community at tha base of the food web in the coastal shelf waters. Every other organism on the shelf is influenced diractly or indirectly by their biomass. Any pollutant thet disrupts tha growth, productivity, population structura and succession of speciss of the phytoplankton will thus disrupt the same variablas in tha othar organisms. Besides tha ecological significance of these othar organisms, be reminded that many of them are commercially important

15. Page I1 - 180, section 5. - The bay snchovy, Anchoe mitchilli, is the most abundant of estuarine fishes, however, it was omitted from discussion of oligohaline systems.

16. Paga 1I - 193, saction (6). - In ell probability, the greatest potentisl snvironmental dangar is in coastal waters, estnaries, wetlends, snd beachas and not at sea. Therafora, tha grestest safegusrds to protact tha coastal anvironment and tha health of coastal residents are needed. The State must be actively involved in planning and decision making in this important mattar.

17. Pega 1I - 222, section H.1. - The southeastern coast of the U.S. is the last significant stretch of land that still has considersbla stretches of undeveloped coastlina. Tha velue of these coastal sreas, as s natural resource, is indisputable and has been emphasized repeatedly in national reports. The long tarm velna of our coastal watere, however, depends upon maintaining s high standsrd of water quality. I am upset that the Depsrtment of Interior can make sweeping generslizetions sbout the impact of oil exploretion, development and production on the biots of the shelf wsters, becsuse such generslizetions are based on so little baseline data. I think it is criticel that e comprehensive study ba on so little bseline data. I think it is critical thst a comprehensive study be funded to assess the current quality of our coastsl wsters so that a date base will exist from which to earva as s basis for futura management decisions of thia srea.

18. Psga LII - 55, section C. - The impact of refined oils is not considered in this raport. It ie obvious thst if 2 processing plants

(refineries) are developed in the S.E. as planned, tanker treffic will be greatly increased to move the refined oils. Thus the probability of of an unfortunate ship accident is increeaed. It is no secret that voletile refined petroleum is many orders of magnitude more toxic to marine organiams than is crude oil.

19. Page III - 122, aection F. - This section atates that an oil apill would have only minimal affect on the littoral zone, yet aurpriaingly, several key publications, that present data on the biological effects of oil apills in littoral areaa are not even conaidered. Those publications moat noticeebly absent from the liat of referencea are:

Bellamy, D. J., Clarke, P.H., John, D.M., Jones, D., Whittick, A., and Darke, T. 1967. Effecta of pollution from the Torrey Canyon on littorel and sublittoral ecoaystems. Nature 216:1170-3.

Blumer, M., Souza, G., and Saas, J. 1970. Hydrocarbon pollution of edible shellfish by an oil apill. Mar. Biol. 5:195-202.

Carthy, J.D., and Arthur, D.R. (eds.) 1968. The biological effects of oil pollution on littoral communities. Fld. Stud. 2(Suppl), 198 pp.

Foster, M., Charters, A.C., and Neushul, M. 1971. The Santa Barbara oil spill. 1. Initial quantitiea and distribution of pollutant crude oil. Environ. Pollut. 2:97-113.

Foster, M., Neushul, M., and Zingmark, R. 1971. The Santa Barbara oil apill. 2. Initial effects on intertidal and kelp bed organisms. Environ. Pollut. 2:115-134.

North, W.J., Neuahul, M., and Clendenning, K.A. 1964. Successive biological changes observed in a marine cove exposed to a large spillage of mineral oil. Proc. Symp. Pollut. Mar. Microorg. Prod. Petrol., Monaco. 335-354.

O'Sullivan, A.J., and Richardaon, A.J. 1967. The effects of the oil on intertidal marine life. In: Conservation and the "Torrey Canyon", Jnl. Devon Trust Nat. Conserv., Suppl., July, 1967, 34-38.

Ranwell, D.S. 1968. Extent of damage to coastal [illegible]ts due to the Torrey Canyon incident. In: The biological effects of oil pollution on littoral communitiea, ed. by J.D. Carthy and D. R. Arthur., Fld. Stud., 2(Suppl):39-47.

Zobell, C.E. 1963. The occurrence, effects and fate of oil polluting the sea. Int. J. Wat. Pollut. 7:173-197.

20. Page IV, section C.1. - Obviously, dateiled engineering date necseeary for pletform end pipaline daeign hes not beon included in the EIS. Reeponsible deaigners end developers will require extensive information on exact conditione et each eite and ehould use the information in the EIS only in a qualitetive aenee.

21. The following lengthy commentary deals with pegee IV - 16 to 19 and pages VIII - 18 to 20.

Information on locetion, extent, end aaaocieted biota of live bottoms ie critically needed. Thees eraas ere the centers of offshore recreational fisheries of South Cerolina. A devsloping commerciel fishery ie dependent on thees features of the shalf. Knowledge of stocks, spewning, and migration of reef fish, which is eseential to predict impact of oil rsleted ectivitiee in thees srees, is sorely lecking.

Stipulatione Which the Stete Should Requeet to Sefeguard tha Environment, Quality of Life, or the Economy of the State, Region, or Local Areas

Special Stipuletion 1,

Regarding "live bottoms" ehould provide e meane of leeseening impacts on the biote. Namely, drill cuttings end mud ehould be disposed of in such e manner ea to not dierupt the communities inhabiting live bottoms in the vicinity of drilling activitiee. Placing of drill rige directly ovsr live bottoms should be probibited.

Special Stipulation 2,

The leasee agreea to make "every reasonable effort" to preserve and protect the natural resource from damage until the supervisor haa given directiona as to ita diapoaition.

RE: Above - is this adequete for protection of an archeological site? Is temporary auapension of operation until aupervisor can give directions too strong a possible option to be inaerted?

Special stipulation 4,

What conatitutes "privileged information" on anything other than oil and gaa reaource and locations data?

Why should leasee noticea to South Atlantic States Governor's Offices not elao be aubject to approval or diaapproval by the Supervisor?

Is 30 days sufficient time for Governor's Office to have to review end comment on the Notice of Support Activity for the Exploration Program by the leasee?

Do such comments bear any real legal weight? Page IV-9, in explanation states only that "the Supervisor, in acting on an exploration plan, will take into account the commenta of the state."

Stipulations which the State should request, in my opinion, should be directed toward the inspection and certification of tankera. Recent evente involving spills ceused by foreign flag tankers have eroused great public concern. The most serious and most likely environmental problem will be caused by oil spills and irreaponsible vessel operetors and cannot be tolereted. Every possible measure to insure thet spills ere contained end cleaned up promptly should be mandeted.

22. Additional comments were received regerding matters beyond the acope of the dreft EIS, however, they are conaidered to ba important for the guidance of future studies, including beselina (benchmark) atudies. They involve the kinds of dete needed, the frequency of data collected and tha scope of particulsr investigetiona. Such comments may be made available to Department of tha Interior upon request.

SOCIO/ECONOMICS

COMMITTEE REPORT

Chairman: Douglas D. Plate

Socio/Economic impacts of the proposed OCS leasing of tracts in the South Atlantic area as stated in the Draft Environmental Impact Statement were evaluated by this committee which was composed of the following groups: The Charleston Trident Chamber of Commerce, S. C. Energy Management Office, S. C. State Ports Authority, S. C. Development Board, and the S.C. State Research and Statistical Services Division.*

Consensus of the group found the Draft Environmental Impact Statement addressed the majority of socio/economic topics associated with development of the OCS area. However, reservations were suggested in the exceptance of specifically selected scenarios as rigid phenomena. These model projections may be misleading if interpreted as the only alternatives for devclopment within the coastal zone. An explanation is needed pointing out the limitations of such scenarios and the inherit difficulties in the extrapolution of the data as extremely accurate portrayals of the socio/economic development associated with offshore exploration and production.

Comments and suggestions prepared by the Socio/Economic Committee are as follows:

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*Major participants in developing these comments include: Douglas D. Plate, Charleston Trident Chamber of Commerce; Greg Prior, S. C. State Ports Authority; Norman Olson, S. C. Development Board; Eugene Laurent, State Research and Statiatical Services Division; and Steve Conner, S. C. Energy Management Office.

of the art and which can make environmental safety and industrial development totally compatible.

The working group concurred completely with the discuasion of Dr. Laurent concerning misleading scenarios, despite the fact thet the working group had no atatistical arguments with any of the proposed acenarios.

Finally, the Charleston Chamber of Commerce resolution of 22 July, 1976, aeems to remaio completely applicable to the situetion.

Mioor commenta on the Draft Environmental Impact Statement are elao aubmitted aa an enclosure.

SOCIO/ECONOMIC WORKING GROUP REPORT

Although the enclosed atetements by the several participants in this working group speek to a significant degree of the desirability of going shead with the development of petroleum resources on the Outer Continental Shelf, there are relatively few specific commeots on the Draft Environmentel Impect Stetement itself. During the discussions of our group, it was concluded thet basically, except as noted in the enclosures, the Draft Eovironmentel Impact Statement is ecceptable as written, and is a reasonably accurate reflection of what ia known about the physical environment of the Outer Continental Shelf, the technology of the systems used to exploit the minerel reaources offshore, and the onshore impacts of such exploitation as can best be determined based on the estimates of how much gas and oil is recoverable.

The point made in the statement by the South Carolina State Ports Authority concerning the need for a navigational fairways system in the South Atlantic, particularly in view of the recent rash of collisions at sea, is an extremely important one. There is no doubt but that the statistical chence of having a massive oil spill as the result of the collision would be aignificantly reduced by the eatablishment of such a fairway system. In a aimilar vain the imposition of strict operational and material requirements upon the tanker industry and close monitoring by the Coast Guard would similarly contribute to a reduction of hazard. Nothing should be left to chance in these areas where we know that improvement can be made.

Although not a comment on the Environmental Impact Statement per se, the State Development Board's statement about the economic well being of the state is a particularly cogent one. Nevertheless, it must be accompanied by those safeguard and monitoring systems which are well within the state

Hinor Commeots on South Atlantic DEIS

The inconsistent use of the unexplained letter "M", meaning 1000 for the most pert in the DEIS, is misleading (viz. ppm). Also, the similar use of e wide veriety of exponential factors (10^5, 10^6, etc) digitsl forms and mathematical words (million, billion, trillion) is confusing and could lead to misunderstendings. It is suggeated thet up to thres digit modifiers of the terms "million", "billion" or "trillion", as eppropriets, be used. Some tebles use hecteres, some acres, some both.

Page I-6 This state oeeds specific assurance thst the Environmeotal Studies program impact studies will ioclude the tidelands erees of South Cerolina.

Page II-216 (pere 8 B South Cerolina) left column last peregreph appears to have lines missing.

Page II-284 Not clear as to which state or arsa some of the discussion epplies. Suggest subdividiog paragraph designetions by stetes.

Page III-31 Teble A-11 Table is inadequately explained. Number of employees?

STATEMENT ON BEHALF OF THE CHARLESTON TRIDENT CHAMBER OF COMMERCE ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT ON THE LEASING OF OUTER CONTINENTAL SHELF TRACTS IN THE SOUTH ATLANTIC, (Vice Admiral Douglas C. Plate, Special Assistant to The President of The Citadel)

In 1975-76 The Charleston Trident Chamber of Commerce conducted an intensive investigation of the impacts and significance of the development of the South Atlantic Outer Continental Shelf. This study involved a number of meetings with briefings by knowledgable officials in all aspects of Offshore Oil Development. Significant field trips were made by members of the Task Force to Northern Scotland and to the Gulf of Mexico to get a first hand look at offshore operations and related onshore impacts. These studies and investigations culminated in the issuance of a report in June 1976, which contained the Task Force's conclusions and recommendations as well as a Chamber of Commerce resolution. This resolution, which was approved unanimously by the Board of Directors of the Chamber of Commerce, is attached as Enclosure 1.

In brief, the report states that it is the consensus of the members of the Task Force that Offshore Exploration and Development, properly managed and controlled, with full utilization of safety features and techniques vouchsafed by modern technology, and with step-by-step monitoring by proper and competent government authority, is in the overall best interests of the Trident area and should proceed in an orderly manner but with all dispatch.

The report contains detailed analysis of energy requirements, possible energy solutions, an analysis of potential South Atlantic resources, a brief discussion of governmental organization and procedures and of the actual processes of surveying, exploration and development, and ends up with a discussion of impacts. A brief excerpt from a summary of the report is given here to show the sense of the findings of the Task Force: "The Task Force has concluded, after careful study of possible impacts on the Berkeley, Charleston, and Dorchester area: that there is, indeed, a critical situation with regard to national energy resources; that the South Atlantic area of the OCS provides a reasonable probability of a modest find of oil and gas; that existing knowledge of the environment, both offshore and onshore, coupled with additional study and a close monitoring effort by appropriate authorities will insure that social, economic, and environmental requirements and standards are met; and that development of the OCS is in the overall best interests of the Trident area and the nation. Again, however, impact is a function of the size and location (s) of a find of oil and gas as well as the thoroughness of regional planning. There are a number of other caveats which are expressed in the body of the study, particularly the need for continued extensive study and monitoring; but the Task Force concludes that there is nothing apparent from our analyses which would indicate that the schedule is inordinately compressed or that there is undue risk in proceeding as planned. In this regard we are impressed with the current technological capabilities of the oil industry, the thoroughness of the inspection systems and the completeness of the operating requirements and orders. At the same time, we are most mindful of the fragility of our invaluable coastal environment and its vital role in our way of life as well as in our economy."

It is the conclusion of those who have reviewed the Draft Environmental Impact Statement that although there are quantitative differences in the estimate of undiscovered recoverable resources, and therefore of the scope of the impacts, there are no substantive differences between the conclusions of the Trident Chamber of Commerce Report and the Draft Environmental Impact Statement. With a few minor exceptions, treated separately, the Draft Environmental Impact Statement is considered as complete as it can be made prior to a determination of reserves. It is also considered as objective and accurate as available information will allow. Finally, it is considered a reasonable basis for proceeding with lease sale number 43. The position of Charleston Trident Chamber of Commerce as stated in their report of June 1976 is, therefore, reaffirmed. The need for additional study and planning as the process proceeds is particularly noted, however.

It should be noted here also that both the Chamber of Commerce Report and the Draft Environmental Impact Statement indicate the desirability of expediting the development of a formal Coastal Zone Management Program which will play a role for the state in determining such things as facility siting, pipeline corridors, anti-pollution measures and other requirements to be levied upon the oil industry.

CHARLESTON TRIDENT CHAMBER OF COMMERCE

A RESOLUTION

WHEREAS, there is a critical energy resource problem in this country brought on by the gradually declining availability of domestic oil and natural gas; and

WHEREAS, there appears to be little possibility of beneficial development of adequate alternative energy resources: solar, breeder reactor, fusion, synthetic, etc., prior to the mid 1990's; and

WHEREAS, maintenance of energy sufficiency for the near term and gradual achievement of energy independence in the long term are stated national objectives which will relieve us from dependence on foreign resources and the resultant undue influence on our national policies; and

WHEREAS, resort to enhanced recovery techniques for existing resources and priority exploration for new resources of oil and gas, will help bridge the gap between our energy needs and our currently known resources; and

WHEREAS, there is strong consensus in our coastal community on the monumental importance to our area of our irreplaceable natural environment; and

WHEREAS, with modern offshore technology, the exercise of adequate care and prudence, and with careful planning by government (federal, state and local), OCS operations should be environmentally sound and socially acceptable; and

WHEREAS, the advent of carefully planned for and controlled additional industry in the Trident area can be economically beneficial to our area and to the State of South Carolina; and

WHEREAS, the provision of adequate onshore support and service facilities is a regional responsibility which is not covered by state and regional tax structure;

NOW THEREFORE BE IT RESOLVED, that the Board of Directors of the Charleston Trident Chamber of Commerce, meeting in regular session on July 22, 1976, do hereby express full support for the program of OCS exploration and development for the South Atlantic area described in the U.S. Bureau of Land Management proposed lease sale, and known as sale area No. 43, with the following provisos:

a. That complete and detailed studies of the areas involved, both offshore and in the coastal wetlands, be initiated as quickly as possible and continued throughout production.

b. That the latest state of the art technological capabilities and safety features based on the latest geologic knowledge be required in all aspects of OCS exploration and development.

c. That there be a formal government body or group, either the proposed Coastal Council of the pending Tidelands Bill, or a group similarly empowered, to pass on such items as proposed pipeline corridors, environmental safety criteria within the Coastal Zone, facility siting, and damage liability, if not covered by federal statute.

d. That a complete State program be developed which will set forth all of the operating criteria which will be imposed upon the oil industry for actions within the Coastal Zone; and that these criteria be made known to and accepted by the oil industry at the earliest possible time and prior to any industry activity in the Coastal Zone.

BE IT FURTHER RESOLVED, that the Charleston Trident Chamber of Commerce strongly recommend to the Governor of South Carolina that the Executive Branch of the State Government immediately sponsor an extensive and detailed study of the impacts of Outer Continental Shelf exploration and development on the coastal zone of South Carolina; or alternatively, that the Governor participate with the governors of the other South Atlantic states on sponsorship of such a study extended to the whole of the South Atlantic.

BE IT FURTHER RESOLVED, that the Charleston Trident Chamber of Commerce does hereby also express support for the principle that federal funding be made available to adjacent states to offset state and regional expenditures brought on by onshore support for OCS development.

BE IT FURTHER RESOLVED, that the key role of conservation in the whole national energy equation be reemphasized by our state and national representatives in all energy related legislation and executive policy.

C. Ronald Coward
President

ATTEST:

James M. Deaton , CCE
Executive Vice President

STATE OF SOUTH CAROLINA
DIVISION OF RESEARCH AND STATISTICAL SERVICES
BUDGET AND CONTROL BOARD
1026 SUMTER ST., SUITE 201
COLUMBIA, S. C. 29201

EUGENE A. LAURENT, PH.D.
DIRECTOR

TELEPHONE
(803) 758-2866

March 22, 1977

MEMORANDUM

To: Admiral Douglas Plate

From: Eugene A. Laurent EAL

Subject: Draft EIS on the Leasing of Outer Continental Shelf Tracts

Enclosed are some rather hurried comments concerning the socio-economic data contained in the Draft EIS. From South Carolina's standpoint, the numbers themselves are not as important as the implication that these numbers cover all reasonable alternatives, are extremely accurate, distribute the impacts properly.

Enclosure

cc: Mr. Norman K. Olson, State Geologist
Mr. Steven D. Conner, Energy Management Office
Mr. G. Ed Richardson, Water Resources Commission

We are concerned that there will be a tendency to accept the information presented in the Draft EIS as the agreed upon or consensus estimate of on-shore impacts resulting from OCS activities. Such an assumption would have the potential of influencing the allocation of Federal impact funds, planning for future locations by business and industry and so on. As discussed below, we do not feel that the figures presented warrant this and that disclaimers regarding the impact data should be discussed thoroughly in the text-not the appendix.

While we have no argument with the Harris model in principle, the presentation of the output of the model is a different matter. For example, most of the tables E-5 through E-21 present the model output in county detail with quantities as small as one additional person being shown. The overall effect suggests extreme accuracy.

While the text accurately states that other equally reasonable assumptions could be incorporated into (a number of) other scenarios the overall effect is to present the five scenarios evaluated as a reasonable range of possibilities and imply that the high projection is a maximum for a given area. This implication probably is accurate with regard to the overall level of impact on the region. However, it is not reasonable to assume that the five scenarios cover the range of possibilities of impact upon specific locations. If the impact were more diffuse, a small number of scenarios could more easily cover the possibilities. However, in all the scenarios presented, the bulk of the economic impact is concentrated in a few locations. This, of course, is reasonable in terms of requirements of the petroleum industry. However, the shifting in assumed location of any one of the proposed major facilities will radically affect the projections for at least two localities. The scenarios presented cover only a small proportion of the possible alignments of facilities. Consequently, the "high" projections are far from the maximum impact which could result if, for example, the refinery were postulated in a location other than Chatham Co., Georgia.

The presentation of "low", "high" and "average" projections is also potentially misleading as the tendency of many users will be to concentrate their attention on the "average" values. These values represent the numerical average of five scenarios based on three mutually-exclusive situations (no oil to shore, oil to shore then out-of-region, oil to shore to refinery in region). The inappropriateness of the "average" is highlighted by the figures for Glynn Co., Georgia, which are essentially an average of zero and an assumed maximum. In no case, could the average value result from one of the five scenarios. A refinery with the associated impacts either locates in Chatham County or it does not. In like fashion, users also are likely to assume that the "high" figures represent the extrems of the range of potential impact for a given area.

Users who understand the basis for the tables still have difficulty in using them due to the necessity for remembering the assumptions for each scenario. These assumptions are not presented in the text or tables but are more than a hundred pages removed to the back. The difficulty of relating the descriptions to the tables encourages the use of the simplistic "high" and "average" figures. To avoid this, the scenarios should at least be summarized in table form in the text.

SOUTH CAROLINA STATE DEVELOPMENT BOARD

Comments as part of consolidated statement
through Office of the Governor, State of
South Carolina, on proposed Lease Sale 43,
South Atlantic Region, OCS

South Carolina, like its neighboring states of North Carolina and Georgia, does not have commercial production of oil and gas. Geologic data compiled from both U. S. Geological Survey and private industry sources indicate the best potential for hydrocarbons in the South Atlantic area to be beneath the Blake Plateau and the Southeast Georgia Embayment of the Atlantic Continental Margin. We support any program by responsible private enterprise to explore for and develop this potential. We realize that current technology is better equipped to cope with possible production of oil and gas because of shallower water depths in the Southeast Georgia Embayment (Lease Sale 43) than over the Blake Plateau. We support any proposal or bill before Congress to provide economic incentives, rather than deterrents, to new exploration and the inherent risks therein in offshore drilling and production. In addition, South Carolina and the coastal states affected by offshore oil and gas operations need Congressional legislation passed to ensure a fair and equitable distribution to the states of the royalties received by the Federal Government from production beneath the Outer Continental Shelf (OCS) areas of the United States.

The coastal region of the Southeast has been designated by Congress as an economically deprived area. In 1966 the Coastal Plains Regional Commission, created through a 1965 act of Congress, consisted of North Carolina, South Carolina and Georgia. In 1975 Florida and Virginia were added. The purpose

of the Congressional action was to provide a vehicle through which it could channel special funds to encourage economic development in this lower income area.

Income levels of the region are still well below the national average. The South Carolina area of the region has a per capita income of only $4,215 as compared to the national average of $6,460. At present South Carolina's per capita income ranks 48th among the 50 states. It is therefore imperative that every reasonable measure be taken to ensure that the people of our state have an opportunity to achieve economic parity with the rest of the nation. We believe that the activities related to oil and gas exploration on the East Coast will have a positive economic impact and contribute to a better standard of living for our people.

We estimate 25,000 to 30,000 new jobs will be needed annually in South Carolina to eventually achieve a four percent unemployment level. The Coastal Plains area of the state alone needs more than 16,000 jobs each year to accommodate those entering the work force for the first time, those who lose their jobs for a number of reasons, and to lower our unemployment to a respectable level. The impact of offshore exploration and related activities could contribute significantly to fulfilling this need. The beneficial effects would be far greater if commercial production became a reality.

Much of the industry of this state is dependent upon this nation's supply of hydrocarbons. Sixty to sixty-five percent of manufacturing employment in South Carolina is related to the textile industry. This industry depends heavily upon petroleum feedstocks. Oil and gas production on the South Atlantic OCS would have a major beneficial effect on stabilizing fuel supplies for

the State of South Carolina. In fact, the benefits will be spread throughout the Coastal Plains region.

We feel in a very positive way that it is possible for the oil and gas industry to develop in the South Atlantic area in an orderly fashion and to construct environmentally safe facilities. Furthermore, major related economic activities can and should be sited in a manner to avoid the unfortunate effects of overdevelopment. The State Development Board will continue to assist the South Carolina Coastal Zone Planning and Management Council as the Council works through county and local governmental groups to ensure orderly economic development for our coastal area citizens.

Petroleum exploration and production activities carry with them an infrastructure (oil well service companies, construction firms, and others) typical of the oil industry. Oil and gas production in the central part of the South Atlantic area, however, would mean even more to South Carolinians in terms of tax revenues and jobs from onshore oil refining and related petrochemical activities sited in an environmentally sound manner in our state. South Carolina is strategically located in the center of the South Atlantic Coastal states as a distribution center.

During the extreme fuel shortages of this past winter, transportation for needed fuel was in critically short supply and pipelines were in danger of losing pressurization. The Southeast was totally dependent upon other areas for its supplies.

South Carolina's textile industry, in particular, suffered because natural gas heat is a vital part of that manufacturing process. There is currently no substitute fuel. In 1977, the worst natural gas shortage ever recorded idled thousands of workers in textile firms and many other industries.

Production and refining capability in our region could substantially ease our dependence upon other states for the diminishing supply of natural gas. Furthermore, commercial production of hydrocarbons in our region would likely have a favorable influence upon decisions to locate new industries here, particularly the capital intensive petrochemical industries.

Presently, the uncertain supply situation which is projected for the Southeast compared to the Gulf Coast is a disadvantage to our state's future growth.

New frontiers, such as the Atlantic Continental Shelf, offer hope for new domestic reserves of hydrocarbons. For us in South Carolina, and the rest of the nation, our position is clear—explore and develop, in a responsible way, as aggressively and as soon as possible.

March 18, 1977

The State of South Carolina

Energy Management Office

JAMES B. EDWARDS
GOVERNOR

DAVID S. HARTER
DIRECTOR

March 18, 1977

The Honorable James B. Edwards
Governor, State of South Carolina
State House
Columbia, South Carolina 29201

Subject: Review of the draft Environmental Impact Statement (EIS) on the proposed 1977 South Atlantic Outer Continental Shelf Lease Sale

Dear Governor Edwards:

It is the expressed view of this office that the cost of further delays or cancellation of the proposed action would be considerable. Such costs would be passed through to all Americans in the form of a net increase in environmental degradation, reduced value of the dollar, lowered standards of living, possible increased energy related unemployment, and continued deterioration of national security interests.

Only a relatively affluent industrialized society can afford to spend the vast sums necessary to insure a clean environment for its citizens. To endanger that capability by reducing the economic resources that an abundant supply of energy makes possible would be self defeating.

In the event of cancellation or delay of the offering, national and regional energy requirements that would otherwise be supplied with OCS product would have to be met from "other sources" including imported oil and natural gas. Such practices would be detrimental to the economies and securities of our state. Such a continued degree of reliance upon these other sources could pose hazards to the environment to an extent greater than would the use of the incremental amounts of resources that are potentially available from South Atlantic Outer Continental Shelf areas.

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The net environmental degradation resulting from such OCS exploration and development may well be less severe than would alternate energy supply augmentation through present methodologies. There are indications that pipeline transportation of offshore products would be less harmful to the ecosystem than would the barge and tanker traffic that is presently needed to perform the same function with existing supplies, both foreign and domestic. Increased reliance on alternative energy sources such as coal, both in its production and consumption, may prove to be less environmentally palatable than would the consumption of offshore products in BTU equivalent quantities.

Having recently experienced the most severe winter weather in recent memory, the all pervasiveness of our requirements for an adequate and readily available supply of energy for an expanding economy should be quite apparent. The potential for a reoccurrence in oil and gas related unemployment in the state and region is substantial. Natural gas cannot easily be transported from other producing countries, and the textile industry is extremely vulnerable to natural gas supply disruption. Unlike some other manufacturing processes, the textile industry in South Carolina and the region must have either natural gas or propane in order to continue its operations. Most propane is derived from raw natural gas production. Were this OCS offering to be either delayed or cancelled, the demand for natural gas for the textile industry would have to be met by either other domestic supplies that have proven to be increasingly unreliable, or by a potentially unstable and more expensive foreign supply. Such circumstances would further compromise the competitive advantage of our textile industry in the world market.

The lease sale in question, although extremely important, should not be the only consideration in any discussion of delays or cancellations. As is pointed out in Section VIII-11 of the Environmental Impact Statement, a delay in the offering may cause delays of subsequent offerings. Such a clear cut precedent may not be in the national interest.

The South Carolina Energy Management Office, therefore, endorses any and all measures that would expedite the development of our domestic energy resources, including the exploration and development of our offshore reservoirs in an environmentally responsible manner.

Respectfully submitted,

David S. Harter, Director

DSH/tea

SOUTH CAROLINA STATE PORTS AUTHORITY

INTERIM DRAFT COMMENTS

DRAFT ENVIRONMENTAL IMPACT STATEMENT ON THE PROPOSED
1977 OUTER CONTINENTAL SHELF OIL AND GAS LEASE SALE

Policy Issues

The South Carolina State Ports Authority believes it is in the national interest to proceed with the proposed lease sale to encourage the exploration of the South Atlantic Outer Continental Shelf for oil and gas resources. Obviously, the National Energy Crisis requires the exploration of all possible avenues to resolve energy shortages and to encourage the economic stability of the nation.

The State Ports Authority also believes that the lease sale and the exploration for oil and gas in the South Atlantic OCS is in the economic interest of the State of South Carolina. The discovery of energy resources off South Carolina can only be expected to aid the energy supply to South Carolina's industries which have recently experienced adverse impacts as a result of natural gas shortages. While development associated with the exploration for petroleum resources will make demands on the coastal infrastructure, we believe that the overall economic impact described in the draft EIS will be positive. Also, it should be obvious that our agency and the state ports' system is directly dependent on adequate fuel supplies for commercial shipping. To the extent that OCS exploration in the South Atlantic can contribute to a stable future fuel supply, it would have a positive impact on South Carolina's participation in ocean commerce.

Adequacy of Draft Environmental Impact Statement

In general, our agency believes the draft EIS adequately addresses the impacts of the proposed action on ports, shipping, and navigation--the subject areas in which our agency has particular expertise. It is also our opinion that the discussion of economic, social and ecological issues is thorough and well-presented. However, we wish to suggest a number of possible amplifications for inclusion in the final EIS.

1. Impacts on Ports (Volume 1, Section C-1, page III-56). This section indicates that only the ports of Charleston, Brunswick, and Jacksonville could expect development during the exploratory phase. We believe the reference should also be made to other ports which have the potential for development during the exploratory phase. The port of Savannah in Georgia and the ports of Georgetown and Port Royal in South Carolina have such potential. We believe this is especially significant in reference to the port of Georgetown which lies closest to one of the major sale areas (approximately 40 miles as compared to 60 miles), has an adequate maintained depth for vessels involved in exploration and has land areas with potential for development in connection with oil exploration that does not exist in some other ports.

2. Impacts on Shipping (Volume 1, Section C-1, page III-SS). This section could be improved by the quantification of the probabilities of a disruption in shipping or the possibilities of a vessel collision. We agree that the overall effect on shipping is likely to be a minor negative one and that the probabilities of a collision are slight. Data is available, however, to quantify this impact.

3. Impacts on Navigation (Volume 1, Section C-1, pages III-

55-58). This section should be included by a more thorough description of the navigation fairways system now existing in the Gulf of Mexico and a consideration of the possibility of the establishment of such a system in the South Atlantic in connection with OCS development. Also, please note that page III-56 cites $111 million damage to a oil platform due to a collision in the Gulf. This is an apparent typograhical error and should read $1.1 million.

4. Impacts on Ocean Dumping (Volume 1, Section C-1, page III-58). Some reference should be included to the potential increase in ocean dumping of dredged material off South Atlantic ports, especially Charleston. Changing regulations on ocean disposal appear to make this more likely in the near future, and the establishment of new ocean dumping sites is a likelihood.

The above comments represent our agency's tentative response to the draft EIS. We wish to reserve the right to modify or expand these comments following the public hearings to be held next month.

March 17, 1977

ARCHAEOLOGICAL COMMITTEE

Cultural Resources

The comments and suggestions generated on the Cultural Resource aspects of the proposed actions described in the Draft Environmental Impact Statement for the South Atlantic OCS area were solicited from the South Carolina Department of Archives and History and the University of South Carolina's Institute of Archaeology and Anthropology.

Responsibilities outlined under Section 106 of the National Historic Preservation Act of 1966, as amended, and under NEPA detail the actions Federal agencies must adhere to in protecting cultural resources. Comments by the State Historic Preservation Office form an integral part of the consultation necessary for these safeguards. We have, therefore, attached both comments as received by this office to preclude any confusion in discharging the State's responsibilities for the review of cultural resource protection in the Draft Environmental Impact Statement.

Major participants in the formulation of these comments include: Dr. Charles E. Lee, Dr. Don Sutherland, and Mr. John Califf of the South Carolina Department of Archives and History; Dr. Robert L. Stephenson, Dr. Alan B. Albright, Mr. Ralph L. Wilbanks, and Mr. Paul E. Brockington, Jr. of the USC Institute of Acrchaeology and Anthropology.

South Carolina Department of Archives and History
1430 Senate Street
Columbia, S. C.

P. O. Box 11,669
Capitol Station 29211
803—758-5816

March 25, 1977

Mr. John L. Rankin, Manager
New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
500 Camp Street, Suite 841
New Orleans, Louisiana 70130

Dear Mr. Rankin:

These comments are given in response to your letter of February 14, 1977 asking for review and comment on the Proposed Lease Sale No. 43 - South Atlantic Outer Continental Shelf.

Our reply follows the spirit if not the letter of the federal procedures for the protection of historic properties (35 CFR 800), which require that the Federal Agency official in charge of a Federally funded or licensed project consult with the appropriate State Historic Preservation Officer. Our reply does not relieve the Federal agency official of deciding for himself whether or not the 35 CFR 800 procedures have been followed or of the final responsibility for reaching an opinion of his own as to whether or not historic values have been adequately taken into account (in allowing the project to proceed). The opinion of the State Historic Preservation Officer is not definitive, either by law or by established Federal procedure. In reaching a conclusion of his own, the Federal agency official may well wish to consult other experts.

We have several comments and recommendations to make about the Department of the Interior's Draft Environmental Impact Statement:

1. Referring to Page II-206, Section II, G. G. E. (4), the second column: we wish to encourage the carrying out of the detailed study along the South Atlantic OCS region to determine geologic trends, in order to make a more accurate estimation of the approximate extent of dry land during Paleo-Indian and later times. Until this can be done, we support the conclusion reached in this same column that "all tracts proposed for leasing...be considered capable of containing prehistoric living sites." We interpret this to mean that, given our current state of knowledge, the archeological potential of all tracts is equal.

2. Referring to Page III-119, Section III. E. 8, Impact on Onshore Cultural Resources, the second column: we feel that the final environmental statement should spell out which existing regulations will guarantee review of onshore development. We also feel that the possibility of onshore development where no

regulations apply and/or where no federal funding or licensing is involved should be addressed.

3. Impact on Onshore Cultural Resources, page III-119: Contrary to III-120, the State Historic Preservation Office will not be called on to review plans for onshore and nearshore facilities for oil drilling operations on the outer continental shelf unless those facilities are Federally funded or licensed. We also emphasize that all comments by the State Historic Preservation Officer are advisory only, and that he is not responsible under either state or federal law for protecting cultural resources from environmental effects of the above facilities. Under Federal law, the Federal agency official funding or licensing such operations is responsible for seeing that the cultural environment is taken into account. Under Section 106 of the National Historic Preservation Act of 1966, as amended, and under NEPA, the responsibilities of the Federal agencies have been clearly written. See the Federal Register of February 10, 1966, or 36 CFR 800.4.

The Draft EIS and other information about this project shows that it will have impacts on onshore cultural sites. Even with detailed safeguards, the EIS shows there is at least a ten percent chance that any oil spill will affect cultural sites. These effects aren't just limited to pollution of archeological sites with oil, they also include effects on the physical and biological environment that surround and are a part of historic and archeological sites.

Any resulting onshore facilities will provide additional impacts, or possible impacts, such as unsightly or out-of-character structures near historic sites, the destruction of archeological sites, and secondary impacts connected with land development, economics, and population trends. The sites shown on the map of the South Atlantic Coast illustrate the density of historical and archeological sites near the South Carolina Coast. The map does not show nearly all the sites listed on the Statewide Historic Sites Inventory and the Statewide Archeological Sites Inventory in the coastal areas.

Types of onshore facilities that are expected have been listed on page I-4 of the Draft EIS. These include pipelines, terminal-storage facilities, gas processing plants, tankers using local ports, onshore operations bases, etc. Any of these can affect cultural resources. There will also be such secondary facilities as commercial areas to serve the primary facilities, housing for oil company employees, changes in real estate values and taxation, and possible shifting of employment trends and industry. This environmental study should make provision for BLM to conduct further environmental studies addressed to all the above facilities and on others, whenever any oil lease in the outer continental shelf is transacted with any oil company.

Oil spills and pollution of the coastal waters could have a great secondary impact on cultural sites onshore. Perhaps a study of the Gulf Coast states would help in refining definition of these impacts. Pollution of fish and shellfish

would hurt the fishing and restaurant businesses associated with historical areas, and discourage fishermen and boating enthusiasts who make up a large part of the tourists who visit historic sites. More direct efforts could be pollution of the waters at a historic plantation listed on the National Register. Dead fish, decaying vegetation, and odors would hurt the atmosphere at these sites that makes them enjoyable places to visit, and lead to the decline of good maintenance of old houses and plantations by residents and historical groups. Any adverse effects on the natural environments in this area would therefore cause adverse effects on the cultural environment. If the Federal and State agencies responsible for pollution control and water quality do a good job of protecting the waters, marine life, marshlands, and beaches, then historical and archeological sites in this matrix should also be protected.

The special stipulations on page IV-16 through IV-18, or similar stipulations, are necessary in order to evaluate possible effects from specific leases and drilling operations. The requirement that the lessee shall submit a "Notice of Support Activities for the Exploration Program;, or a similar type of notice, is needed for the Federal, state, and local agencies to accommodate onshore development. Municipal and county agencies, as well as the state, need the information in the "Notice" in order to plan for onshore development. Local agencies and groups that need notification include the following:

County governments and zoning boards
County historical societies and commissions
City governments and zoning boards
City historical societies and commissions
Regional councils of governments

4. Referring to Page VII-18-19, Section VIII. D. 6, Alternative Administrative Procedure to Protect Cultural Resources and "Live Bottom Areas and Mitigate Potential Impact from Unexploded Munitions, Paragraph 2, "Cultural Resource Survey": we strongly prefer the alternative stipulation that is stated in this section to the stipulation proposed in Section IV. D. on Page IV-17. Our reasons for preferring the alternative in Section VIII. D. are as follows:

   a. The alternative provides a broader base for considering the necessity for survey beyond remote sensing. Whereas the stipulation in Section IV. D. places this responsibility solely in the hands of the Supervisor, who will apparently act only when he believes that cultural resources are present, the alternative includes the Bureau of Land Management in this decision. Considering the general lack of knowledge about underwater cultural resources, the opportunity should be available to conduct surveys even when evidence for the existence of such cultural resources is minimal.

   b. The alternative in Section VIII. D. provides that data from underwater preliminary surveys be reviewed and evaluated by a marine archeologist rather than by the supervisor alone. We feel that the marine archeologist should be involved in the decision-making process regarding recommendations for survey beyond remote sensing at an earlier stage than is provided for in the stipulation in Section IV. D.

In addition to preferring the alternate stipulation provided in Section VIII. D., we would further suggest the following changes and additions to the alternate stipulation:

   a. The opening sentence of the stipulation concerning cultural resource survey allows either a remote sensing and/or another type survey. Does this wording make it clear that some type of survey will be reouired? At lease a remote sensing survey should be required on all leases, and this requirement should be made clear in the stipulation to confirm the intent originally stated in Section III, C.M., Page III-63.

   b. In regard to the remote sensing survey, we feel that a minimum listing of techniques to be used should be incorporated in the stipulation. These should include at least magnetometer, sidescan and shallow seismic testing, with consultation required between the technicians who gathered the data and the marine archeologist reviewing it. We feel that the stipulation should further provide for consultation with marine archeologist prior to remote sensing survey in order to obtain their recommendations as to how the various techniques employed should be carried out.

Finally, we feel that the stipulation should include a provision for protecting and mantaining all original remote sensing records.

   c. In regard to the results of remote sensing and other surveys related to cultural resources, we suggest that the stipulation include a provision for the publication and dissemination of these results to the professional community and to appropriate public agencies. Provision should also be made that the data not be available to the general public until appropriate protection measures have been taken.

The survey reports should also include, insofar as possible, the reconstruction of submerged paleo-environments, rather than a mere reporting of the presence or absence of sites or objects. This would be valuable to the marine archeologist in increasing his capability to predict the locations of cultural resources, and thus to refine sampling strategies for future surveys.

As a matter of information, the comments provided in this letter were formulated in consultation with the Office of the State Archeologist, Institute of Archeology and Anthropology, University of South Carolina. We both feel that the Department of the Interior, Bureau of Land Management has certainly produced a thorough and commendable Environmental Impact Statement. We congratulate you.

Sincerely,

Charles E. Lee
State Historic Preservation Officer

CEL:vd
CC: Dr. Robert L. Stephenson
Institute of Archeology and Anthropology
University of South Carolina

Ms. Kathy Hendrix
Waccamaw Regional COG

Ms. Cindy Cole
Lowcountry Regional COG

Mr. Elias Bull
Berkeley-Charleston-Dorchester Regional COG

UNIVERSITY OF SOUTH CAROLINA
COLUMBIA, S. C. 29208

INSTITUTE OF ARCHEOLOGY AND ANTHROPOLOGY

March 30, 1977

Mr. Clair P. Guess, Jr.
Executive Director
South Carolina Water Resources Commisaion
P.O. Box 4515
Columbia, South Carolina 29240

Dear Mr. Guesa:

I would like to congratulate you and Mr. Ed Richardson for putting together a well organized and meaningful conference to draft a set of unified atate-agency commenta on the Draft Environmental Impact Statement for Outer Continental Shelf Sale Number 43. Our comments, for inclusion in your aummary report, are presented below. These comments were developed by several persons on our staff, including myself, Mr. Alan B. Albright, Mr. Ralph L. Wilbanks, and Mr. Paul E. Brockington, Jr. In developing these comments we worked closely with the South Carolina Department of Archives and History, represented by Dr. Donald A. Sutherland.

1. Referring to Page II-205, Section II, G, 6, e, (2), Column 1, paragraph 5: We feel that the potential for shipwrecks in South Carolina waters is understated. We concur that North Carolina and Florida waters are already known to contain numerous shipwrecks; however, a great many wrecks are known for South Carolina waters, and the srea has a very high potential, particularly near the port areas of Charleston, Georgetown, and Port Royal. The absence of a large number of National Register aites in the South Carolina coastal zone, terrestrial and underwater, indicates only that the necessary time and/or financial support has not been given to locating these sites. Several partial lists of known wrecks have been compiled to date. References to these lista are attached.

2. Referring to Page II-206, Section II, G, 6, e, (4), the second column: We wish to encourage the carrying out of "the detailed atudy along the South Atlantic Outer Continental Shelf region to determine geologic trends, in order (to make) a more accurate eatimation of the approximate extent of dry land during Paleo-Indian and later times." Until this can be done, we support the

conclusion reached in this same column that "all trscts proposed for leasing will hsve to be considered capsble of conteining prehistoric living sites." We interpret this to mean that under our current state of knowledge, the srcheological potential of all trscta is equal.

3. Referring to Page III-119, Section III, E, 8, Impact on Onshore Cultural Reaources, the second column: We feel that the final environmentsl ststement should spell out which existing regulations will guarantee review of onshore development. We also feel that the possibility of onshore development where no regulations apply and/or where no federal funding or licensing is involved should be addressed.

4. Referring to Psge VIII - 18-19, Section VIII, D, 6, Alternstive Administrative Procedure to Protect Cultural Resources and "Live" Bottom Areas and Mitigate Potentisl Impact Prom Unexploded Munitions. Paragraph 2, "Cultural Resource Survey:" we strongly prefer the alternative stipulation (to be included in any lesse issued) stated herein to that provided in Section IV, D on Page IV-17. Our ressons for this are as follows:

   a. The slternative in Section VIII, D provides a broader base for considering the necessity for survey beyond remote sensing by including the Bureau of Land Management in this decision. The stipulstion in Section IV, D places this responsibility solely in the hands of the Supervisor, who will apparently act only when there is, in his opinion, already resson to believe thst cultursl resources are present. Considering the general lack of knowledge about underwater cultural resources even by the most knowledgable marine srcheologists, the opportunity should be svailable to conduct surveys even when evidence for the existence of such cultural resources is minimal.

   b. The alternative in Section VIII, D provides that dsta from underwater preliminsry surveya be reviewed and evaluated by a msrine archeologist rather than by the Supervisor alone. We feel that the marine srcheologist should be involved in the decision making process regarding recommendations for survey beyond remote sensing st an earlier stage than is provided for in the stipulstion in Section IV, D.

In addition to preferring the alternete stipulation provided in Section VIII, D, we would like to suggest a number of changes and additions to it es follows:

   a. Tha opening sentence of the stipulation stetes that the lessee shall conduct a remote sensing snd/or other survey as specified by the Supervisor. Does this wording make it cleer that some type of survey will be required? Prom reading Section III, C, 7, Page III-63, "Prehistoric Living Sites," it is our understanding that e Cultural Resource Survey will initially be required on all blocks leesed, to cover e 20% sample grid of each block. Thet et least a remote sensing survey will be required on all leases should be made clear in the stipulation.

   b. In regard to the remote sensing survey, we feel that a minimum listing of techniques to be used sbould be incorporated in the stipuletion. These should include, but not be limited to, magnetometer, sidescan, and shallow hazard profiling (ell used in conjunction with navigation and depth recording equipment) with consultation between the technicians who gsthered the data and the marine archeologist reviewing it provided in each case. All the above instruments should be updated as technology develops. Furthermore, we feel that the stipulation should provide for consultation with qualified marine archeologists prior to issuing the notice to lessees and operstors. Pinelly, we feel that the stipulation should include a provision for the protection and curation of all original remote sensing records for future study.

   c. In regards to the results of remote sensing snd otber surveys relsted to cultural resources, we suggest that the stipulation include a provision for the publication and dissemination of these to the professional community and to appropriate public agencies. Included in this, however, should be a requirement that the data not be available to the general public until appropriate measures to protect reported cultural resources have been taken.

   Additionally, we feel that the survey reports should, insofar as possible, include tbe reconstruction (interpretation snd explanation) of submerged peleo-environments, rather than a mere reporting of the presence or absence of sites or objects. The value of this to the marine archeologist is the increased capability it could give him to predict the locations of cultural resources snd thua to refine aampling strategies for future surveys.

As a whole, we consider the Dreft Environmental Impact Statement to be thoroughly researched and well written, with much concern for the cultural resources which may be affected. We congratulate the Bureau of Land Management on this fine job. Although we view the recommendations in our comments as essential to proper consideration of cultural resources, we see the implementation of these recommendations as minor adjustments to the program as stated in the Draft Environmental Impact Statement and do not feel that they would in any way significantly impede or hinder the granting of leases and attendant production development.

Thank you again for this opportunity to work with you in making formal comments. I look forward to further cooperstion in the future.

Sincerely,

Robert L. Stephenson
Director and Stste Archeologist

RLS:sja
Attachment
cc: Mr. Chsrles E. Lee
Dr. Donald R. Sutherland

INFORMATION ON SOUTH CAROLINA SHIPWRECKS

Berman, Bruce D.
1972 Encyclopedia of American Shipwrecks. The Mariners Press, Boston.

Brassey, T. A. (Editor)
1886 James Navsl History of Creat Britain. Naval Record Society, London.

Clsrk, William Bell (Editor)
1969 Naval Documents of the American Revolution. Vol. 4. U.S. Covernment Printing Office, Washington.

Clowes, William Laird
1899 The Royal Navy: A History from the Earliest to the Present. Vol. 4. Sampson, Low, Marston and Company, London.

Marx, Robert F.
1971 Shipwrecks of the Western Hemisphere. The World Publishing Company, New York.

Naval History Division
1971 Civil War Naval Chronology 1861-1865. U.S. Government Printing Office, Washington.

Petit, James Percival (Editor)
1976 South Carolina and the Sea: Day by Day Toward Five Centuries 1492-1976 A.D. Vol.1.Walker, Evans and Cogswell Company, Inc., Charleston.

Shomette, Donald G.
1973 Shipwrecks of the Civil War: The Encyclopedia of Union and Confererate Navsl Losses. Donic Ltd., Washington.

Spence, E. Lee
1976 Spence's Cuide to South Carolina. Southern Printing, Charleston.

STATEMENT: GOVERNOR JAMES B. EDWARDS, STATE OF SOUTH CAROLINA AT PUBLIC HEARING ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT ON THE PROPOSED 1977 OUTER CONTINENTAL SHELF OIL AND GAS LEASE SALE (SOUTH ATLANTA SALE NO. 43), CHARLESTON, SOUTH CAROLINA.
MARCH 31, 1977.

Ladies and gentlemen, I regret thet my schedule does not permit ma to personally be here to represent the atate; however, I have asked my Executive Assistant, Bill Workmen, to appear on my behalf to take a part in these very important deliberetions.

I am confident that this hearing will give the citizens of South Carolina an opportunity to openly discuss their views and thoughts on the development of our Outer Continental Shelf and provide those of us in government a great deal of useful information.

I wish to also thank the Secretary of Interior and the Bureau of Land Management for holding hearings both in South Carolina and Georgia in ordar that all concerned with OCS exploration and development in our Stata can discuss these important subjects with Federal pfficials, face to face.

South Carolina is dedicated to promoting healthy aconomic development while meintaining our environment. I am confident that together we can meat both of these goals while we work to improve the quality of life for all of our citizens.

The State of South Carolina strongly supports the exploration and development of the hydrocarbon resources of the Outar Continental Shelf. We believe thet such ectivity can be done responsibly and with a minimum of harm to the anvironment. I am convincad that technology is advanced to the point of providing edequata protection for the environment; off-shore drilling has bean done in the North Sea, in the Indonesian erea, and in tha Gulf of Mexico, pieces in which operationa are extremely difficult. These operetions hava been very successful, with faw, [redacted] anvironmentally harmful incidents.

I do not see how any responsible person can say that the critically needed resources of the Outer Continental Shelf should not be developed, with the proper environmental safeguards by the petroleum industries, and by government. South Carolina has a substantial set of industries dependent upon the preservation of the beaches and estaurine ecosystems. I believe these important coastal areas can be protected and still have rapid development of the oil and gas resources of the Outer Continental Shelf.

Potential for the betterment of this Nation and for the improvement of the economic well-being of South Carolina, a state whose per capita income is 49th in the nation, is great through OCS development and must be realized.

The official detailed comments by the State of South Carolina on the draft environmental impact statement are now being formulated. They are intended to be constructive, either to correct or supplement the information contained in the Draft EIS or to point out areas for which additional information is considered essential. They will represent a consensus of various State agencies and ecademic departments involved in the multi-disciplinary aspects of the projected OCS exploration and development. Includad in our comments will ba recommendations that certain courses of action suggested in the Draft EIS be followad. These will safeguard the "live bottom" fishing grounds, protect archeological resources, and cause a minimum of disturbance to the near shore/on shore natural environment throughout the exploration and devalopmant of tha offshore hydrocarbon resources.

We also favor the issuance of lease stipulations and development plan criteria which will give maximum information to State, regional, county and municipal agencies concerned with the planning and programming needed to absorb the impact of the OCS operations upon our economy.

One final point. In cases involving State comments on lease stipulations, reports, and devalopmant plans, I believe the Governor of an effected state must be provided direct, formal access to the Secretary of the Interior in the avant his recommendations are not accepted by the U.S. Geological Survay supervisor. I can conceiva of such action occurring only in the cases of highly significant and critical impact upon the natural environment or upon the socio-economic status of the State and its communities. I think you can sea the need for State consultation with either the Secretary or his immediate staff under such circumstances.

We appreciate the opportunity to comment on the Draft Environmental Impact Statement for the proposed 1977 OCS Sale #43 and trust the comments suggested are taken in a spirit of cooperation in this most important matter. We urge the expeditious completion of the processes leading to the lease sale this fall, and to the earliest reasonable development of these critically needed resources.

GOVERNOR JAMES B. EDWARDS
STATE OF SOUTH CAROLINA

Presented by: W.D. Workman, III
Executive Assistant

MAR 4 1977

State of South Carolina

JAMES B EDWARDS
GOVERNOR

OFFICE OF THE GOVERNOR
POST OFFICE BOX 11450
COLUMBIA 29211

March 3, 1977

Mr. G. Ed Richardson
S. C. Water Resources Commission
Post Office Box 4515
Columbia, South Carolina 29240

Dear Mr. Richardson:

A draft Environmental Impact Statement (EIS) on the leasing of Outer Continental Shelf tracts in the South Atlantic area has been issued by the United States Department of Interior, Bureau of Land Management. This statement has been distributed by the Department of Interior (DOI) to your agency.

Public hearings will be held by DOI at Savannah, Georgia, on March 28 and 29; and at The Citadel, Charleston, South Carolina, on March 31 and April 1, 1977, to permit interested parties to state their views on the EIS and to clarify questions. State comments are due by April 15, 1977. The public hearings and state comments are to be used by DOI to assist in determining whether or not to proceed with the scheduled lease sale, exploration, and development of oil fields off our shores.

The stated objective of the State of South Carolina, as presented to the Secretary of the Interior, is to encourage prompt action to explore and develop the OCS oil off South Carolina shores, but to do so in a manner which will protect both the near-shore and on-shore environment. Response to the EIS, along with State review of lease, exploration, and development plans, will contribute toward meeting South Carolina's objectives.

A coherent and unified State position on the EIS is necessary. A meeting to receive comments from state agencies and institutions will be sponsored by my office at 10 a.m., March 18, 1977, in the Ways and Means Committee Room in the State House. You are requested to attend this meeting and to present comments on the EIS. These comments should be in written draft form. Your comments should include:

- Information which will clarify, supplement or correct that contained in the EIS
- Areas in which essential information must be obtained (if lacking in the EIS)
- Stipulations which the State should request to safeguard the environment, quality of life, or the economy of the State, region or local areas.

In preparing your draft comments, please attempt to be sensible in the amount of effort which can reasonably be expected of federal agencies in preparation for the proposed lease sale. The energy needs of our State's economy are great and growing, particularly in the need of natural gas for our textile industries and domestic use.

With warmest personal regards,

James B. Edwards

James B. Edwards

JBE/tbc

cc: Senator Waddell
Senator Roddey
Senator Doar
Senator Garrison
Senator Carter
Senator Drummond
Representative Ed Bennett
Representative Dangerfield

MARINE ENVIRONMENT COMMITTEE

Dr. Vic Burrell *	Marine Resources Research Institute
Dr. John Vernberg	University of South Carolina
Dr Harry Freeman	College of Charleston
Dr. Arnold Schwartz	Clemson University

SOCIO/ECONOMICS COMMITTEE

Admiral Douglas Plate *	
Mr. David Hartar	Energy Management Office
Mr. Don Welch	State Ports Authority
Mr. Robert Leak	State Development Board
Dr. Andy Laurent	Research & Statistical Services

ONSHORE/NEARSHORE ENVIRONMENTAL COMMITTEE

Mr. G. Ed Richardson *	S. C. Water Resources Commission
Dr. Wayne Beam	S. C. Wildlife & Marine Resources Department
Mr. Charles Jeter	State Department of Health and Environmental Control
Mr. John Parrie	State Land Resources Conservation Commission

ARCHAEOLOGICAL COMMITTEE

Dr. Don Sutherland *	S. C. Department of Archives & History
Dr. Al Albright *	U.S.C. Archaeology Institute

* Indicates committee chairman.

OCS COORDINATION MEETING
18 March 1977

NAME	ORGANIZATION
Henry Fulmer	Land Resources Commission
Roger W. Mudd	Land Resources Commission
Paul Brockington	Office of State Archeologist
Ralph Wilbanks	Office of State Archeologist
W. M. VanHarlingen	OCS Advisory Board
Clair P. Guess, Jr.	S.C. Water Resources Commission
G. Ed Richardson	S.C. Water Resources Commission
J. Gregory Prior	S. C. State Ports Authority
Douglas C. Plate	Charleston Trident Chamber of Commerce
James A. Timmerman	S.C. Wildlife & Marine Resources Dept.
Wayne Beam	S.C. Wildlife & Marine Resources Dept.
V. G. Burrell, Jr.	S.C. Wildlife & Marine Resources Dept.
Cliff Hawkins	S.C. Dept. of Health & Environmental Control
C.R. Jeter	S.C. Dept. of Health & Environmental Control
F. John Vernberg	University of South Carolina
Steve Conner	S.C. Energy Management Office
Donald R. Sutherland	S.C. Department of Archives & History
John Califf, III	S.C. Department of Archives & History

APR 1 4 1977

STATEMENT BY SENATOR STROM THURMOND (R-SC) BEFORE A PUBLIC HEARING IN CHARLESTON, SOUTH CAROLINA, REFERENCE A PROPOSED OIL AND GAS LEASE SALE FOR THE SOUTH CAROLINA OUTER CONTINENTAL SHELF. APRIL 12, 1977.

LADIES AND GENTLEMEN:

Over the past winter, this Country experienced the most serious energy shortage within memory. People in all sections of the Nation suffered greatly. Since the Southeast is almost totally dependent upon other parts of this Country or foreign Countries for its fuel, it had a special problem.

As you are well aware, much of the industry in South Carolina is dependent upon oil and natural gas. For example, the textile industry, which provides 60 to 65 percent of manufacturing employment in the State, operates with gas. When the scarce resources of oil and gas were being allotted, the Southeast was at the end of the line. The winter of 1977 produced the worst natural gas shortage ever recorded, putting thousands of textile workers out of their jobs. Something must be done to prevent this from happening again.

Taking a broader view, the United States as a whole is dependent upon oil and gas for over 75 percent of its energy. Over 40 percent of the oil comes from abroad. These figures give foreign governments the ability to extort political and economic concessions from the United States. That is just what they tried in the oil embargo of 1973-74, when overdependence on them was even smaller than it is today. Something must be done to prevent this overdependence from reoccurring.

Unfortunately, it is not currently possible to turn to other forms of energy to make us self-sufficient. Such energy sources as wind, solar, ocean, geothermal, and fusion still require years of development. Because of constant--and effective--protests by environmentalists, nuclear energy and coal are still questionable as a source of this Nation's needed energy. The recent decision by President Carter has resulted in the breeder reactor and plutonium reprocessing being indefinitely delayed.

This assessment of the energy situation in South Carolina and the United States clearly establishes the need for exploring and developing the Outer Continental Shelf. According to government estimates, the potential recoverable resources of energy underlying the Outer Continental Shelf of the United States range up to 49 billion cubic feet of natural gas. Even though now only 3 percent of the shelf has been opened by the government for leasing, the Outer Continental Shelf supplies 20 percent of our domestic natural gas and 16 percent of our crude oil production. This is the equivalent of one out of every six cars driven by motorists on the East Coast being run on fuel from offshore oil production.

Despite the tremendous potential for oil and natural gas in the Outer Continental Shelf, I would have to oppose leasing of this property if I believed that it posed environmental dangers. However, that is not the case. Current drilling technology minimizes the chance of oil pollution in offshore drilling operations. During the past 28 years, when over

20,000 offshore wells have been drilled in United States waters, the oil industry has established a reasonably good record of pollution-free operations. While there have been several accidents, in only one of these did oil reach the shore and cause pollution of the beaches; and it was temporary, at that. The oil was cleaned up rapidly, and scientific studies show no lasting damage was done.

Moreover, exploratory and production work would have no ill effect on South Carolina's resort areas since it would take place well out of sight of land in the range of 25 to 90 miles beyond visible horizons.

Without any doubt, the natural gas and oil reserves thought to lie beneath the Outer Continental Shelf of the Atlantic Coast are a potential source of more convenient and dependable energy than these east coast States can now obtain. If these supplies are found and utilized, the economic benefits to these States will be tremendous.

Reliable sources of energy close at hand will help retain existing industry, and even assist in encouraging expansion of factories and attracting new industry. Additional benefits will include cheaper fuel because transportation costs will be lower. Also, local business will have the opportunity to provide some of the equipment and supplies for the production effort.

I appreciate having the opportunity to be heard on the Draft Environmental Impact Statement for the proposed 1977 OCS

Sale #43. I urge a speedy completion of this process, with the goal of selling the lease by this fall. I also urge the quickest, practical development of offshore oil and gas.

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
U.S. COAST GUARD (G-WS/73)
WASHINGTON, D.C. 20590
PHONE (202) 426-2262

22 APR 1977

Manager, New Orleans Outer
Continental Shelf Office
Bureau of Land Management
Hale Boggs Federal Building, Suite 641
500 Camp Street
New Orleans, Louisiana 70130

Dear Sir:

This is in response to the letter of the Deputy Assistant Director, Bureau of Land Management, dated 11 February 1977 addressed to the Department of Transportation Water Resources Coordinator concerning the OCS lease sale No. 43 of 225 tracts offshore North Carolina, South Carolina, Georgia and Florida.

The concerned operating administrations and staff of the Department of Transportation have reviewed the material submitted. The Coast Guard commented as follows:

"The physical size of the DEIS is deceptive since its double columo format makes the approximately 700 pages a massive documeot. In this regard, an executive summary treating major environmental issues would greatly facilitate review of the DEIS by decision makers who do not have the time available to read, let alone digest and evaluate, the entire document. The summary on the reverse of the DEIS title page is hardly adequate for such a review.

"P. 1-6-7: The enviroomental monitoring program ehould continue throughout the life of the project and include productioo and abandonmeot, as well as exploration and development, with the results considered in taking remedial actions to mitigate adverse environmental impacts which might be uncovered.

"P. 1-13: The statement that the Coast Guard performs surveillance for oil spills and discharges along pipelnee from offshore facilities to the shore is misleading since it infers that the Coast Guard conducts dedicated surveillance patrols to detect pipeline leaks. The Coast Guard conducts pollution eurveillance patrols to detect oil discharges withio territorial and cootiguous waters. Occasional patrols are made within

"Pp. III-12-16 and Appendix M: The analysis of oil spill probabilities does oot specifically ideotify spills associated with 'offshore oil terminals' io the text although one or two are expected, and terminals are included in table A-5. 1. Since SPM's are the most likely type of offshore oil terminals and unloading ports have historically had about one spill io every 17 veesel calls (with a significantly poorer record for loading facilities), they would represent a significant percentage of the expected oil spill incidents.

"P. III-19: The EIS statss here that analysis of pipelins routes will oot be undertakeo unless late stages of exploration indicate sufficient oil is prsseot to warrant pipeline transport. However, the EIS indicates potential for chronic oil leaks from pipeline transportation (page III-3), and earthquakes could cause pipeline rupture (page III-6). Since pipelines, if constructed, would become an integral part of this project, pipelioe corridore ebould be identified and eignificant potential impacts identified above addressed io the final EIS.

"P. III-30: Although at the time of the articie the ECOL refinery was an independent, Marathon Oil ie in the process of or has rscentiy purchased this facility.

"P. III-43: More recent analyees of the impacts of deepwater ports are cootained io the Coast Guand final EIS's on the LOOP and SEADOCK projects. Theee documents, which also include the status of othsr deepwater port proposals, were filed with CEQ on 17 December 1976.

"P. III-55: No mention ie made of Savannah as a possible site for development of operations activities related to eervicing offehore facilities.

"P. III-56: The damage figures for veeeel-platform collisions are inconsistent. In one paragraph it is etated that io eight incidents involving veeeels over 1,000 tons, $3.2 million in damages to platforms reeulted, while in the following paragraph a eingle one of the eight is described as reeulting io $111 million in platform damages.

"P. III-56: Navigational fairwaye, whether Corps of Engineere safety fairwaye ilmiting fixed etructures or IMCO traffic eeparation lanes, are geoerally not mandatory and veseels are free to either use or ignore them at their own risk.

"P. III-113-19: Oil spills are capable of imposing eignificant dollar costs to recreational areas and cause lost income to touriet facilities, whicb ebould be discuseed in sections III E 6 and 7.

"Pp. IV-4-5, IV-13 and G-61-2: The discussioo of OCS order 7 ehould include the poseibility of requiring poilution response equipment offshore on the platform to reduce response tims in the eveot of an oil spill. Thie action would be constatent with the Coast Guard'e Deepwater Port Regulations (33 CFR 149.319) and provide environmental benefits in light of the estimated 12-bour response time (p. IV-12).

"P. IV-11: Under Section B.1., paragraph 4 should be clarified to reflect that Coast Guard Captains of the Port located at Miami, Jacksonville, Savannah, Charleston, and Wilmington respond to all reported poilution incidents and if necessary, request assistance from the Gulf Strike Team of the Coast Guard based in Bay St. Louis, Mississippi. If oeceeeary, the Coast Guard Strike Teams are capable of providing equipment and pereonnel resources. The Coast Guard Districts do oot rely primarily on the National Strike Force for pollution response equipment, but use primarily contractor, oil spill cooperative and local Coast Guard equipmeot to respond to most spills. National Strike Force equipmeot is used to supplement locally available equipment wheo required.

"P. IV-12: Uoder eubsectioo 3, paragraph 1, the EIS states that the BLM is unaware of existing oil epill containment capabilities within the U. S. South Atlantic OCS area. Existing oil epill contalnment/cleanup cooperatives are located along the South Atlantic Coast at Charleston, Jacksonville, and Port Evsrglades. Although capabilitiee of theee cooperatives are limited, they are availabis for OCS use. The discussion of curreot oil spill technology is highly optimtstic in light of the present atate of the art equipment and the recent Argo Merchant experience. A caveat that 'Murphy's Law' often takes effect during an oil spill would probably be appropriate.

"P. 14-16: In addition to EPA's SPCC plan, oil transfer terminals will normally be required to have a Coast Guard Operations Manual under 33 CFR 154.300.

"P. V-3: Although not as well underetood as near-shore spills, offehore spills impact wildlife, e.g., whalee, fish, etc.

"Pp. V-5 and 6: EPA has receotly stated a policy of trade-off regarding HC emieeions. This policy has eignigicant potential as a mitigative measure and could preveot increased air emiseions from becoming an unavoidable impact.

"Mitigating Measures in the Proposed Action. Generalities frequently appear throughout this section dealing with the question of oil spill response in broad terms. Reference is made to extsting or proposed oil spill containment capabilities in the South Atlantic OCS region, supported by an oil spill cooperative, Clean Atlantic Associatee. However, all equipmsnt referred to is presently located in Rhode Island under the Mid-Attantic OCS region. A statement is made of plans to establish a elmiliar base of operations for the South Atlantic rsgion and here liee the divergence from epecifics. South Atlantic OCS Order No. 7 calls for a detailed Oil Spill Contingency Plan separate and distinct from the EIS. However, to fully asssss the possible impact resulting from discharged oil, it is necesaary to review actual (not proposed) lmmediate response capability. Impact will certainly vary with the ability to contain and control discharge of oil. Comments are also made regarding equipment eufficient to handle one spill with back-up capacity for a second concurrent spill. The magnitude of these spills in relation to equipment capability is not addreseed. It ie suggeeted that further detailed elaboration be made regarding specific amounts/type of equipment, location, deployment, and overall response capability in relation to varying degrees of spill magnitude.

"Shipping Densities and Navigation. The amount of ehipping in this area is considerable and navigational accuracy is marginal. The Coast Guard ts pressing for procedures which provide betier data on location of offshore structures to transiting mariners. The first step has been taken in Southern Californis OCS lease area. The Corps of Engineers is presently examining comments on publtshed 'Intent to Establieh Guidelinee for Permits for Exploratory Drilling Operations' (41 FR 44715). If these guidelines are acceptable to interested parties, the Coast Guard intends to press for eimliar procedures in all OCS areas.

a. The Coast Guard has taken the position that offehore interests should share in any inconvenience (correlate with riek) to shipping resulting from our nation's energy needs. In general, the Coast Guard will pursue the following policy with respect to competing sea surface interests,

(1) Allow exploration on OCS under carefully controlled circumstances (41 FR 44715, or similar).

(2) Assess actual resource deposits as they impact upon ehippit. in the approaches to U. S. ports.

(3) When potential proliferation of resource development installations indicate, utilize shipping safety fairways (Corps of Engineere) and

traffic eeparation schemes (Coast Guard) as appropriate to organize shipping eafety through development areas.

b. There are no traffic separation schemes in thie area; however, eome may be eatablieh ed in the futurs. Shipping Safety Fairways may be used to ensure that exploitation of ses-bed resourcss does not adversely affect shipping eafety in transit areas. Should exploration rsvsal extensive resources, designation of fairwaye may be necessary to provide a eafs path for shipping. Vessels are not required to use thsse aids although certain procedures must be foliowed by vsseels using a traffic eeparation scheme. With further crowding of the eea surface, shipping would probably relinquish eome of its traditional flexibility to follow preecribed paths designed to maximize eafety."

The Office of Pipeline Safety Operations in ths Materials Transportation Bureau commented as follows:

"All pipelines should be designed, constructed, operated, and maintained in accordance with 49 CFR Part 192 for natural gas pipelines and 49 CFR Part 195 for liquid pipelines."

The Departmsnt of Transportation has no other comments to offer nor do w have any objection to this lease eale. The final etatement, however, shoul address the concerns of the Coast Guard and the Materials Transportation Bursau.

The opportunity to review this draft statement is appreciated.

Sincerely,

P. P. SCHUBERT
Captain, U. S. Coast Guard
Deputy Chief, Office of Marine
Environment and Systems
By direction of the Commandant

APR 27 7 57 AM '77

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

INSTALLATIONS AND LOGISTICS

APR 27 1 34 PM '77
22 APR 1977

Manager
New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
New Orleans, Louisiana 70130

Dear Sir:

This is in response to your request of February 11, 1977, for Department of Defense (DoD) comments on the proposed outer continental shelf oil and gas lease sale number 43. We do not anticipate that the proposed action will conflict with our ongoing activities in the vicinity of the sale area. We do wish to make known that sonic booms may occur, however. DoD utilizes offshore areas and international airspace to conduct supersonic flights. Such areas are used partly to avoid noise disturbance to populated land areas.

We recommend that Volume I, paragraph II G.4, Military Use of the Continental Shelf, be amended to reflect that sonic booms may occur in the vicinity of the sale area.

Should you have further questions, please contact Mr. H.R. Smith on 695-0221.

Sincerely,

George Marienthal
Deputy Assistant Secretary of Defense
(Environment and Safety)

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

DEPARTMENT OF THE ARMY
South Atlantic Division, Corps of Engineers
510 Title Building, 30 Pryor Street, S.W.
Atlanta, Georgia 30303

SADPD-R

18 April 1977

MAY 5 9 26 AM '77

U.S. Department of the Interior
Bureau of Land Management
New Orleans OCS Office
New Orleans, LA 70112

Gentlemen:

Personnel within the South Atlantic Division, Corps of Engineers, have reviewed the Draft EIS on Proposed 1977 OCS Oil and Gas Lease Sale and offer the following comments:

a. The DEIS is fairly complete and addresses all the issues within the proposed action. The information presented indicates that with development of the OCS for oil reserves we can expect oil spills. The DEIS describes briefly the role of the U.S. Coast Guard and some of the technology available to cope with oil spills. This discussion is brief and not commensurate with the level of analysis used for other aspects of the proposed action. Since oil spills are a major concern, the institutional and technological factors affecting a cleanup operation should be discussed in full detail. Details, including diagrams, should be used to portray the capability and limitations of a hypothetical cleanup operation based on case histories. The cost of such an action, the financial responsibility and the ability and extent of government or private enterprise to provide protection from an oil spill should be discussed.

b. OCS leases should include special provision for oil spill liability and damage. Lessees should be strictly liable for all damages, including the total cost of control and removal of the spilled oil, and third party damages. Reference for patterning is made to the Trans-Alaskan Pipeline Authorization Act of 1973 (Title II of P.L. 93-153), or the Deepwater Port Act (P.L. 93-627) and S. 521, Outer Continental Shelf Management Act of 1975 (Section 23).

SADPD-R

18 April 1977

In addition to the above, the following revisions are suggested:

a. Page II-94 - "cell counts ranged from 75,000 to 75,000/l appears to be in error.

b. Page III-23 - Physio-chemical Fate b, axidation should ba oxidation.

c. Page III-56 - Damage to oil platforms is reported as 3.2 aillion and lll aillion. One figure appears to be in error.

d. Page III-65 - The phraseology used to describe dredged material as spoil is sometimes aisleading. Numerous uses for the material range from construction purposes to marsh development. We suggest that the term spoil be replaced with the term dredged material.

e. Page III-73 - The last sentence "There would not be any cumulative impact as a result of this or future sales on the general air quality of the region." seems inconsistent with the air quality data presented, especially with regard to the City of Savannah. Savannah's air quality, as presented in the DEIS, is already degraded primarily by chemical processes used in paper processing plants. An oil refinery, if built in Savannah, will certainly add to the degradation. Thus, the conclusion reached in the DEIS seems inconsistent with particular regard to the City of Savannah. Acknowledged is the fact that a separate EIS would be forthcoming should plans for a refinery develop.

It should be noted that Departaent of the Army Permits will be required for structures built or placed on the Outer Continental Shelf. Also, permits will be required for support facilities or structures located within the territorial seas.

Sincerely,

Kenneth McIntyre

KENNETH E. McINTYRE
Brigadier General, USA
Division Engineer

MARINE MAMMAL COMMISSION
1625 EYE STREET, N. W
WASHINGTON, DC 20006

2 May 1977

Mr. Curt Berklund
Director
Bureau of Land Management
Department of the Interior
18th & C Streets, N.W.
Room 5660
Washington, D.C. 20240

Re: DEIS on OCS Sale No. 43

Dear Mr. Berklund:

The Marine Mammal Commiasion, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the Draft Environmental Impact Statement (DEIS) for the propoaed 1977 Outer Continental Shelf Oil and Gas Leaee Sala in the South Atlantic, OCS Sale No. 43. As a reeult of thia review, and purauant to our responsibilitiea under Saction 202(a) of the Marine Mammal Protection Act of 1972, we make the following commente and recommendations.

Description of the Environment (Marine Mammals -- Pages II-110 to II-113)

This section of the DEIS should identify tha statue of each species or population of marine mammal found in or adjacent to the proposad sale area. The information provided is incomplete, inadaquately documented, and, in some caaes, misleading or incorrect.

Paragraph 3:

Statements and infarences related to tha Marine Mammal Protection Act are inaccurate, as well as misleading. In enacting the Marine Mammal Protection Act, Congress recognizad that "marine mammals hava proven themselves to be reaources of great international significance, aesthetic and recreational as well as aconomic..." and that "certain

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DIVISION OF MINERALS
ENVIRONMENTAL ASSESSMENT

species and population stocks of marine mammals ara, or may be, in danger of extinction or depletion aa a result of man's activitias." Thia paragraph impliea, however, that marina mammals have no valua other than economic, and that Congraas enacted the Marine Mammal Protsction Act becauea "...thay [marine mammala] all have an aesthatic eignificance that haa been widely publicized." The DEIS, aa exemplified by this paragraph, faila to identify either tha economic or aesthetic value of marine mammala, or to recogniza that commercial exploitation end habitat loas already have had a eignificant impact on certain speciea or populations. Although Table E-11 liets five endangered apecies, no mention ia made aa to how theaa speciea came to be endangered.

Paragraph 5:

Although the DEIS pointe out that "knowledge of marine mammal populations ia incomplete" (p. III-42) and that there ia "little information on life hietoriee of the cetaceane in tha araa" (p. III-49), paragraph five indicates that with a few exceptione, auch aa the aei whele, marine mammal populationa in the weetern North Atlantic are relatively atable. Cleerly, there are inconsietenciea in theae varioue statementa. Purthermore, the etatement that "there is no evidence to augeeat that the fluctuatione in food stock have affected the cetaceana, and weather playa a minor role in thair population dynamica" ia mialeading becauee it impliee that fluctuations have not affected cetaceane. The relationehip betwaen tha abundance of moet marine mammal populetiona and thair prey species ie largely unknown. Similarly, it ia not known how waather affecta the reproduction and aurvivel of marine mammala. Therefore, without citing relevant atudies, it ia inappropriate to aeaert that weather pleye a minor role in marine mammal population dynamica.

Paragraph 6:

The atatement that "theae speciea [presumably meaning manateaa and bottlenose dolphine] ere probably the moet vulnerable of all marine mammala to man's activitiee..." ie accurate only if it refere apecifically to marine mammala in the propoeed sale area. If it refere to marine mammale in general, aeveral other speciee (e.g., the eea otter, gray aeal, etc.) ehould be mentioned as equelly vulnerable.

Paragraph 7:

The eecond eentence makee no eenee, probably because one or more linee have been omitted: -- i.e., "Theae whalee

are the black right whala and the humpback whale ara conaidered endangered and tha fin whale is considered vulnerabla by an intarnational group (IUCN, 1972)." The phrase "no dolphins, pinnipeds, or odontocetes" is ambiguoua becauae the cetacean auborder Odontoceti includes dolphina or porpoisea, aa well as aperm whales and other toothed whales.

Paragraph 8:

Documentation must be provided for the statement that "the pigmy sperm whale and the gooaebeaked whale, for example, hava long bean termed as rare species, but recent evidence (namely greater observational effort) auggeata that thay are, in fact, rather common."

Paragraph 9:

The statement that "the Florida manatee population is increasing in Plorida end its range has extanded to South Carolina" is inaccurata and mialeading. Available data are not sufficient to determine whether the population is increasing or remaining etable (letter dated 22 March 1977 from Dr. Daniel K. Odell, Univereity of Miami, to Ms. Jane Anderson, Marine Mammal Commission). Manateea hietorically inhabited areas aa far north ae Virginia and, whereas it might be accurate to etate that the species may be recolonizing northern parte of ite former range, it is inaccurate to atate that the range has been extended to South Carolina.

Contrary to what is steted in paragraph nine, it is not definite that "manateea migrate offehore and avoid the extremely ahallow flete and weterwaya near coastal inlete." Manataea basically are coaatal inhabitante, eeldom moving away from land and it hea not yet been determined whether aummer movemente are actually migratory (letter deted 7 March 1977 from Dr. Howard W. Campbell, Fieh and Wildlife Service, to Ms. Jene Anderson, Marine Mammal Commieeion).

Paregraph 10:

The assertion thet the majority of maneteee aurvive in "iaolated pockete" ie felee. Manateea are dietributed throughout the acceeeible coaetel end inland watera of Floride, wherever weter depth ia adequate. In winter, they epparently tend to eeek werm weter areae, often congregeting around natural epringa or power plante. Thie tendency to form

winter congregations may have led to the impression that they exist in "isolated pockets" (letter from Campbell, op. cit.)

Table E-11 (pages II-111 and II-112)

This table is incomplete and contains numerous errors as noted below.

Common Names and Scientific Names:

The minke whale (Balaenoptera acutorostrata) and long-finned pilot whale (Globicephala melaena) should be added to the table. The West Indian manatee should be designated as an endangered species. The following typographical errors should be corrected:

[Rough-toothed Whale]	Rough-Toothed Dolphin
[Manatee West Indian]	West Indian Manatee
[Eugalena glacialis]	Eubalaena glacialis
[Mosoplodom mirus]	Mesoplodon mirus
[Ziphus cavirostris]	Ziphius cavirostris
[Zelophus californianus]	Zalophus californianus

The scientific name of the sei whale is Balaenoptera borealis, not B. acutorostrata.

Population:

Although the DEIS repeatedly points out (pp. III-42 and III-49) that little is known about marine mammals in the proposed sale area, Table E-11 cites "no data" for the status of only one population. Moreover, it is not clear whether the table (and narrative) refers to the status of species or to the status of populations (stocks). For example, is the sei whale declining in all parts of its range or only in the North Atlantic? Unless population data are provided, or reference is made to appropriate literature, "no data" or "unknown" should be substituted for "stable" or "increasing" in the table.

With reference to the sperm whale, it seems likely that the author means "above maximum sustainable yield levels" rather than "above maximum substanance levels."

The adjective "feral" refers to domestic animals that have reverted to a wild state. It is not an appropriate adjective to describe species that have escaped from captivity. More precise terms are "exogenous" for the California sea lion and "extralimitel strays" for the hooded seal. The harbor seal is a "natural" inhabitant of the area, and may be seasonally common as far south as North Carolina (Unpublished data, Dr. James Mead, Smithsonian Institution). It is conceivable that the seasonal migrants are juveniles from more northerly populations and it therefore is possible that breeding populations, as far north as New England, could be impacted adversely by activities in the proposed sale area.

Migration:

The DEIS, as exemplified by Table E-11, simply states that certain species of marine mammals are migratory, inferring that they move into or through the proposed sale area on a seasonal basis. Such general information is of little use for predicting the impact of the proposed sale. The discussion of the right whale (p. II-128), for example, provides no specific information on when, where, or why the species moves through the proposed sale area. Knowledge of the right whale's migration is particularly important because this species is endangered throughout its range and the loss of even a few animals might have a significant adverse impact. Right whales with very young calves have been seen close to shore along the east coast of Florida (personal communication from Randall R. Reeves, Smithsonian Institution to Robert J. Hofman, Marine Mammal Commission), suggesting that the species' productivity could be affected by the proposed sale.

Distribution:

Nearly every species listed in the table ranges outside the proposed sale area. It therefore is inappropriate and misleading to list the distribution as "N. Carolina-Florida", "S. Carolina-Florida", etc. The table would be more accurate and more useful if this column were labeled "Frequency of Occurrence" and species were listed as "Rare", "Common", "Abundant", etc. within the proposed sale area.

Table E-11 apparently was compiled from two sources -- Roberts, 1974 and Dept. of Commerce, 1976. The bibliography contains no entry for the Dept. of Commerce citation.

Description of the Environment (Endangered Species -- pages II-128 and II-129)

Like other sections of the DEIS, this section lacks detail and supporting documentation. As noted earlier, there generally is inadequate data to state reliably that certain populations are "stable" or "increasing". Sei whales have been singled out, for no apparent reason, as the only species for which "sightings are too sparse to make a judgment concerning population."

The failure to discuss why these species are endangered is an oversight that must be corrected.

The humpback whale is "considered stable in the study area", and it is stated that "during winter they migrate southward to Bermuda, the Bahamas and the West Indies to mate and calve." These statements incorrectly imply that the humpback whale is a summer resident of the proposed lease area. In truth, it moves through, or adjacent to, the lease area on its northward and southward migrations, and more detailed information on its movements is needed to assess the potential impact of the proposed sale.

In the paragraph on sei whales, the statement that "... this mammal is near the level of a viable population size and therefore potentially on the verge of decline" is incomprehensible.

The discussion of manatees is an almost verbatim repetition of the discussion on page II-113 and, like the earlier discussion, is superficial.

Environmental Impacts of the Proposed Action (Impact on Marine Mammals -- pages III-49 and III-50)

This section should provide a comprehensive and objective evaluation of the potential impact of the proposed action on marine mammals. Instead, as noted below, it provides an incomplete and biased evaluation, resulting in conclusions that are unwarranted on the basis of available information.

Paragraph 1:

This paragraph states that the "direct effects of oiling on marine mammals could include the matting of pelage, irritation of skin and eyes....", and that "secondary impacts may include decrease in or redistribution of food

supplies." No mention is made of possible lethal effects. Furthermore, no mention is made of the possibility that oil could foul baleen plates, thus impairing the feeding efficiency of balsen whales.

Paragraph 2:

The first sentence states that "twenty-two species of cetaceans, including three endangered species...have been sighted in recent times (the last 50 years) off the South Atlantic states." However, Table E-11 lists 24 species of cetaceans, five of which are endangered, and does not indicate that some species have not been sighted during the last 50 years.

Paragraph two also states that "there is...little information on the life histories of the cetaceans in the area" and that "lack of frequent sightings may be attributable to the absence of observers." The last sentence in the paragraph then concludes that the absence of data "...may indicate that only individuals would be impacted by oil spills as a result of the proposed sale." Clearly, there is faulty reasoning behind this conclusion.

Paragraph 3:

This paragraph states that "there were no reported sightings of dead whales following the Santa Barbara oil spills," whereas paragraph 10 states "numerous dead animals [were] found after the [Santa Barbara] spill, including grey, sperm and pilot whales, dolphins..." Obviously, one of these statements is incorrect.

Paragraph 4:

This paragraph indicates that inhaletion of oil may cause pneumonia in cetaceans and then concludes with the statement that "there were no reported sightings of dead whales following the Santa Barbara oil spill." The last sentence is a non sequitur that is both misleading and inconsistent with previous statements in the paregreph. It implies, without any supporting evidence, that there is a basis for concluding that cetaceans will not inhale oil -- i.e., they are able to detect and avoid oil spills.

Paragraph 5:

Certain species of large cetaceans migrate thousands of miles to forage in relatively localized areas characterized

by high primary and secondary productivity. These feeding areas are not randomly or uniformly distributed in the world's oceans and it therefore is incorrect to conclude that "...because of the large area foraged, this [localized decreases or redistributions in the abundance of prey species] would not be expected to limit overall availability of food supplies for cetaceans" or that "...uptake by cetaceans of substances generated by routine operations would be expected on only a limited basis because of their large forage area." Without a comprehensive knowledge of species-specific feeding areas within the proposed lease area, and knowledge of how related activities might affect each species in the food web, there is no basis for predicting second order affects on marine mammals.

Paragraph 6:

With the exception of Megaptera novaeangliae, every sciantific name in this paragraph is misspelled. Also, the paragraph states that populations of humpback whales, right whales, fin whales, and sperm whales are increasing, but provides no data or litarature citations to support the assertion. Table E-11 on page II-111 indicates "no data" for the population status of the fin whale and "above maximum substanance (sic) levels" for the sperm whale.

Paragraph 8:

This paragraph notes the "apparent paucity of cetaceans in the South Atlantic" and then attempts to argue that, because of this paucity, cataceans are unlikely to be impacted as a result of the proposed sale. The argument is not persuasive, and is inconsistent with the statement in paragraph two that "lack of frequent sightings may be attributable to the absence of observers."

Paragraphs 9, 10, 11, and 12:

These paragraphs discuss the potential impacts of the proposed sale on pinnipeds. Of the three species that are discussed (California sea lions, harbor seals, and hooded seals), only the harbor seal is indigenous to the proposed sale area. Although there are no known breeding sites for the harbor seal in the proposed sale area, there are insufficient data presented to justify the statement that "impact on individuals would not be expected to impact populations." As noted earlier, significant numbers of harbor seals may occasionally be found as far south as North Carolina and it therefore is conceivable that certain

populations of harbor seals could be impacted as a result of the proposed sale.

Paragraphs 13, 14, and 15:

These paragraphs note that "there has been no investigations (sic) performed regarding the results of the manatee ingesting contaminated food", and that "due to the mobility of the manatee they would probably avoid any direct contact with an oil spill." Manatees, unlike other marine mammals, are herbivores and ingestion of oil, or oil contaminated food, conceivably could affect intestinal bacteria needed to digest otherwise indigestible vegetation. Recognition of the need for studies to determine the effects of ingesting oil, or oil contaminated food, is conspicuously absent in the DEIS. Furthermore, there is no empirical evidence to suggest that manatees are able to detect and/or avoid oil, and to imply otherwise is irresponsible.

Environmental Impacts of the Proposed Action
(Endangered Species -- pages III-69 and III-70)

Although Table E-11 lists five cetacean species that have been declared endangered under the Endangered Species Act, only the potential impact on manatees is discussed in this section. Furthermore, there are discrepancies between the information presented in this section, and that presented on pages II-113 and III-50.

Paragraph 5:

The manatee's distribution in the South Atlantic is described as having "changed little in recent years...with appearances in Georgia being relatively uncommon and exceptional in South Carolina." However, page II-113 states that the manatee population is said to be "increasing in Florida and its range has extended to South Carolina."

Paragraph 6:

The statement that "pollution from a lease site is considered remote due to the distance the tracts are from the estuarine areas" is contradicted by a statement on page III-50 that states the "oil spill trajectory...indicates that the projected route could go towards the Florida coast." The probability of an oil spill impacting manatee habitat should be calculated and included on Table A-8 on page III-21.

Paragraph 8:

This paragraph states that "...the most serious impact on the manatee population would result from increased ship traffic in the harbors." Paragraph 6 on this same page states, however, that "the primary adverse impact to the species [manatee]...is that of habitat destruction through water pollution and possible pipeline laying or onshore operations." It is unlikely that the "most serious impact" and the "primary adverse impact" are two different things. Furthermore, the assertion that increased ship traffic likely will cause the "most serious impact" appears to be contradicted by the statement in the same paragraph that "...in view of the population distributions of the manatee the probability of their habitat locations having an increase in ship traffic is slight." Further confusion is contributed by the statement on page III-50 that "any increase in shipping will have a toll on the existing manatee populations around the harbors."

Irravarsible and Irratrievable Commitment of Resources
(Fish and Wildlife Resources -- page VII-1)

This section, like those discussed previously, contains statements that are misleading and/or unsupported with appropriate data or references to available literature. For example, the preceding sections appear to provide no basis for anticipating that "...an affected area will recover from a spill and that the natural flora and fauna would eventually reoccupy spill areas." Similarly, as noted earlier, there may be no relationship between mobility and the ability to avoid oil spills. Therefore, there is no reason to conclude that "the species involved are highly mobile and can avoid oil spills."

The bias, whether intentional or unintentional, found throughout the DEIS clearly is apparent in the statement that "there is insufficient evidence to conclude that low-level spillage or other activities associated with the proposed sale can [emphasis added] lead to an irreversible commitment of fish and wildlife resources." The purpose of the DEIS is to identify the risk associated with the proposed sale and, on the basis of information presented in the DEIS, the proper conclusion is that there is insufficient evidence to determine that the proposed sale will not result in irreversible damage to fish and wildlife resources.

Conclusions and Recommendations

In January 1976, BLM circulated its Marine Environmental Study Plan for the South Atlantic Outer Continental Shelf Area Georgia Embayment and Blake Plateau Regions, a "comprehensive, multi-year plan of environmental study" developed to fulfill requirements under the minerals management goals of the Department of the Interior. In the section of the plan entitled "Anticipated Environmental Studies, South Atlantic OCS Area", it is stated (p. 27) that:

> A synthesis of the existing data on marine mammal...populations including geographic distribution, migration routes, and numbers shall be done in the first year. An evaluation of those data shall be made to determine whether or not additional studies need to be conducted to document the presence and location of these important elements.

The following description of marine mammal studies is presented in the section entitled "First Year OCS Environmental Studies Plan."

> Marine Mammals and Turtles
>
> Objective: To enhance the data base on marine mammals and turtles off the Southeastern Atlantic Coast.
>
> Mechanism: Examine the present data base, published and unpublished, and evaluate the sufficiency of these data to provide a broad description of marine mammals and turtle populations.
>
> Information such as species present, abundance, strandings, migration routes, and general geographical distribution will be synthesized. Unpublished data that has not been analyzed will be identified and evaluated as a source of useful information.
>
> Purpose: To provide descriptive information on populations that might be impacted by oil and gas development. (Ibid, p. 41)

It is evident that a comprehensive literature search on marine mammals was either never conducted or never consulted

in the preparation of the DEIS. Relevant information hes been presented ineccuretely and misinterpreted. Numerous published end unpublished sources have not been consulted. These deficiencies are exemplified by e critical lack of ewareness concerning current and past studies of the manatee in Florida.

Despite the fect thet the West Indian manatee is an endangered species, and is one of the marine mammals most likely to be impacted by the proposed sale, there ere only two references in the DEIS specificelly releted to menatees. The first of these is e literature citetion for an article by D. S. Hartman published eight years ago in the Netional Geographic Magazine (DEIS, pp. II-113 and II-129). The other reference is to "further work...being conducted regarding population densities and habitat of menatees by Reynolds et the University of Miami" (p. II-113). There is no reference to Reynolds in the bibliography or elsewhere in the DEIS. Furthermore, John Reynolds is a greduate student with Dr. Deniel Odell, University of Miami, end is involved only in a portion of Odell's manatee program. Odell's program end the extensive work being carried out by the U.S. Fish and Wildlife Service ere not noted at ell.

In view of the fact that the available date base hes not been assessed thoroughly, it seems likely that no attempt was made to determine whether additional studies are needed. Although the DEIS repeatedly cites the leck of information on marine mammals and the effects of gas and oil development ectivities on them (p. II-111, II-112, II-128, III-42, III-49, and III-50), the environmental study program described on pages I-6 to I-9 in the DEIS, includes no reference to existing or planned studies concerning marine mammals.

Since it is clear that the DEIS does not provide an eccurate or edequate assessment of the potential impacts of the proposed sale on marine mammals or the ecosystem of which they are a pert, we recommend thet:

1. the services of the following scientists be sought to essist in revising the DEIS --

   Dr. David K. Caldwell (porpoise)
   Dr. Howard W. Campbell (manetees)
   Mr. Bleir Irvine (porpoise, menatees)
   Dr. James G. Mead (porpoise, whales end seels)
   Dr. Deniel K. Odell (manatees, porpoise, whales, and seals);

2. sections of the DEIS concerning marine mammals be redrafted after all relevent information has been reviewed and eveluated objectively;

3. the sale be delayed if there are insufficient deta to conclude that the proposed action will not be to the disadvantage of marine mammal populations or the ecosystem of which they are e part; and

4. additional studies, as necessery, be initiated if the available deta base is judged inadequate either to predict or monitor the impact of the proposed actions on marine mammals or the ecosystem of which they ere e part.

If, for any reasons, you are uneble to comply with the above recommendations, please provide us with e deteiled written explanation es required under Section 202(d) of the Marine Mammal Protection Act. Please be advised that your response will be made public in one of our periodic reports to Congress.

Sincerely,

John R. Twiss, Jr.
Executive Director

cc: Mr. John Rankin

Section 10

Bibliography

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